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PROCEEDINGS

OF

The Newport
Natural History Society,

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1884-5.

NEWPORT, R. I.,
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*The founder of the Society, May 9, 1883.

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At a special meeting of the Council of the Newport Natural History Society, held March 9th, the following resolutions were presented and unanimously adopted :—

Resolved, That in the death of Hon. Samuel Powel this Society has lost one of its most valued vice presidents ; Science, one of its purest votaries ; and Newport, one of her best citizens :—

Resolved, That his love of nature and her wonders was only equalled by his spotless integrity as a man, a student and a senator :—

Resolved, That his public and private example are the highest praise that can reflect on himself, his friends and his family :—

Resolved, That we tender our sincere sympathy to the bereaved ; and that it be recorded on the minutes of this Society.

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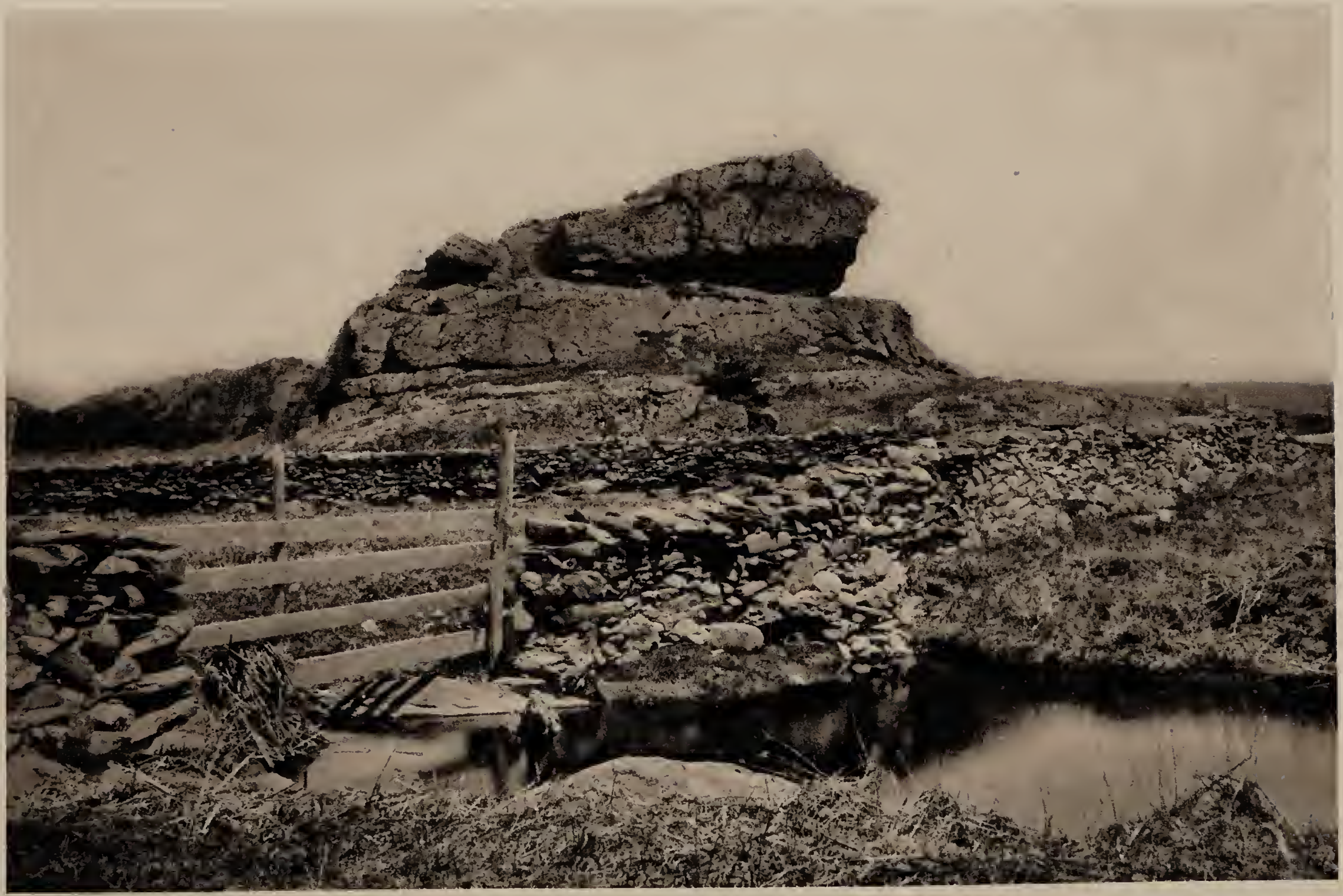
*Through payment of $100.



ARTOTYPED,

BY J. A. WILLIAMS.

THE HANGING ROCK, NEAR NEWPORT, R. I.

THE GEOLOGY OF THE MOUTH OF NARRAGANSETT BAY.

By T. NELSON DALE.[*]

In two papers recently published, one in the Proceedings of the Boston Society of Natural History, the other in the American Journal of Science, I have given the scientific details of the subject, which I now propose to present in a more general and popular form.

There is probably no one present who has not been often impressed with the beauty of the shores and islands of our bay. To some of us, these scenes are associated with all the experiences of our childhood, to others, they have but formed the theatre of our maturer life or merely charmed us during seasons of rest and recreation. To all who in these different degrees and ways have felt the influence of our natural surroundings, it ought to be of interest to know how these lands and waters came to be, what is their structure, what changes did these places see before the red man invaded their solitude. As every intelligent person likes to know something of the history of the community in which he resides, of its political, social, intellectual and religious past, so should he also desire to extend his knowledge to the natural history of the section he inhabits. Indeed we would find a by no means contemptible culture in acquainting ourselves as thoroughly as possible with what has transpired within a few miles of our own doors, both in the sphere of man and in the sphere of nature.

With the offer of such inducements I invite you to a study of the general geological structure and history of the mouth of Narragansett bay, that is of the lands and waters for about seven miles on the east and as many on the west of Newport, together with all the headlands south of it. I shall have to ask you first to accompany me in thought as I outline on the map the boundaries of the different kinds of rocks in our vicinity, with many of which you doubtless already possess some acquaintance. We will begin in Newport itself. It is well known that coal seams exist under the City. They have been struck in digging wells and they used to crop out near Sheep Point on the Cliffs. Coal plants have been found near the corner of Marlborough and Farewell Streets and in several places along the Cliffs. The slates and fine conglomerates associated with these fossiliferous and carboniferous strata extend from Sheep Point on the south, to Almy's pond, Emmanuel Chapel (corner Spring and Perry Streets) and Fort Greene on the west, to Coddington Point and Bishop Rock on the north, and to Bliss cave, Easton's Beach and the Cliffs on the east. In the vicinity of Taggart's Ferry, Wood's Castle, at the Glen, and on the east shore of the east passage between High Hill and Brown's Point, we find other patches of these beds. On the west, the same group recurs at Beaver Head and Dutch Island, although in a more crystalline condition, the coal having there become graphite and the clay slate a mica schist containing garnets. The vertical thickness of this series is about 2000 feet. At the end of "the Cliffs" you will have noticed some very jagged greenish rocks which recur at the east end of Bailey's Beach, forming apparently a belt from that place to the Cliffs; these rocks are chlorite schist, talcose schist, epidote, and probably serpentine. The marked peculiarity of these different minerals is that they contain a considerable percentage of magnesia, and one of them, the epidote, some 23 per cent. of lime.

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[*] Lecture delivered before the Society on June 5th, 1884.

The Hanging Rock or Berkeley's Seat, represented in the accompanying Artotype, forms the southern extremity of Ridge VI. (described in detail, in the paper "On the Geology of the tract known as 'Paradise' near Newport," in the Proceedings of the Society for 1883-4) and consists of quartzyte conglomerate dipping W. NW. The abrupt face of this Rock was caused by a fissure which cleft the pebble and cement of the conglomerate alike, from which it is inferred that the Rock had been previously compressed into a mass of almost equal density and cohesion through some powerful force. The view is taken from the South.

The only other place where similar rocks occur is on Conanicut near the S. E. corner of the island and also most of the Dumpling Islets. There, however, the chlorite schist contains passages of calcite and a little mica, corresponding exactly to some of the Paradise rocks, and suggesting the possibility that they were deposited at the same time. We may therefore perhaps venture to classify the alternating beds of hornblende and chlorite schist, and mica schist (traversed by veins of zoisite which is related to epidote,) which form the three central ridges of Paradise, in the same series, and indicate it on the map with the same color.

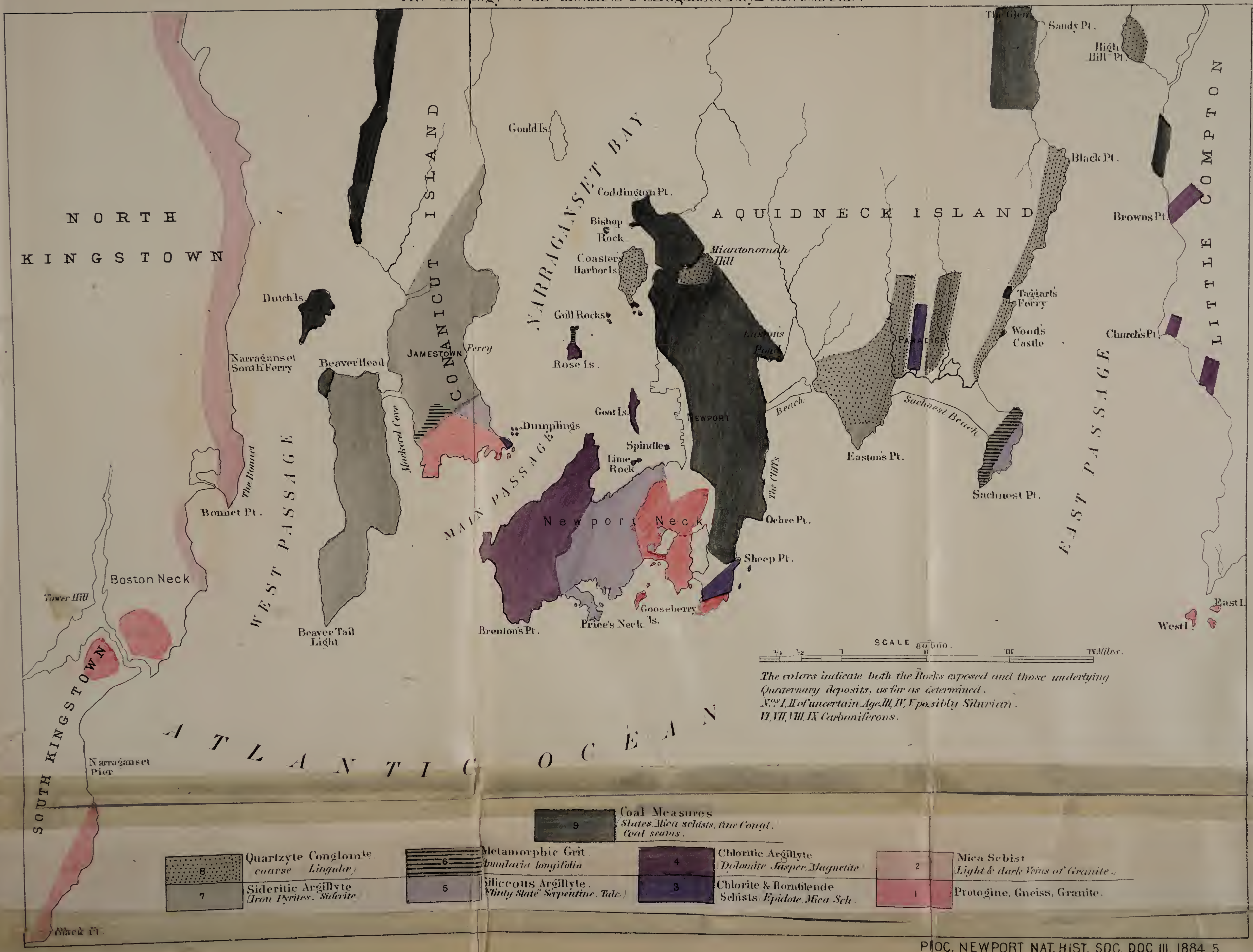
The thickness of these rocks along the Cliffs is about 400—600 feet and the Paradise series measures about 950—so that we can adopt 400′ and 900′ for the extremes. Both at the Dumplings and Bailey's Beach, these greenish magnesian rocks lie upon a pinkish rock which might easily be mistaken for a granite, but which is more correctly a protogine, the mica of the granite being replaced by the dark greenish magnesian mineral, chlorite. The protogine is characterized in places by crystals of feldspar an inch in diameter, and in others, by the presence of two shades if not two kinds of feldspar, a pale greenish and a pinkish color. Although it has been supposed to be eruptive, it is clearly stratified, and therefore a sedimentary rock, highly metamorphosed. This protogine forms the point about the Boat House, Gooseberry Island, and the region about the Lily pond, extending from the west side of Lily pond beach to a point opposite the Little Lime Rock. It forms also the southern part of the northern extension of Conanicut. About Narragansett Pier, from the steamboat landing south to within two and one-half miles of Point Judith, protogine passing into a gneiss with black mica occurs, and the same rock constitutes also East and West island, on the other side of the bay. The thickness of these beds of protogine is not easily computed. It is at least 1200′ and probably much greater. West of the protogine tract of Newport Neck and forming the central part of it is a "flinty slate" in places containing serpentine and talc. This rock lies upon the protogine, as may be seen at several points, and as is conclusively proven by the presence of two small patches of the flinty slate near the middle of the protogine tract, on the west side of Lily pond.

The western boundary of the flinty slate extends from Brenton's Cove to the west side of Price's Neck. The same recurs at Conanicut forming a triangular shaped mass north of the protogine, and also on Sachuest Neck where associated with a slaty conglomerate it forms a belt on the east side. The thickness of this series varies from 500′—2000′. The remainder of Newport Neck consists of a series of alternating green and purple slates with passages of calcite and occasionally red jasper. The rock (chloritic argillyte) forms also the greater part of Rose Island, the Gull Rocks, the southern extremity of Coaster's Harbor Island, the Coaster's Harbor Rocks, Goat Island (as ascertained by a recent well boring), the Little Lime Rock and some submerged rocks southwest of it. To this series belong also the Lime Rocks, where layers of magnesian limestone are associated with purple slates. On the Little Compton shore the green slates recur, extending from Brown's Point to Church's Cove. From the outcrops of these rocks in our harbor, we may infer that they originally extended from the Little Lime Rock to Coaster's Harbor Island, to Rose Island and thence to Castle Hill, occupying the entire harbor and the passage (indicated by the space included within this line). The great veins which traverse these rocks often abound in chlorite, with which occurs also a pink feldspar. The series measures from 500′ to 2000′.

Before proceeding, I ought to make mention of some rocks on the Narragansett shore north of the Pier, which are not represented on this island. They are mica schists, dark and light alternating, containing here and there rounded quartz pebbles and traversed by veins of cream colored granite some of which are very powerful. This series extends from Wickford south to Watson's Pier and a mile or more inland. It measures about 1450′ in thickness. Its position in reference to the other beds is somewhat uncertain, but it probably is not far from that of the protogines. At the north end of Rose Island and the southwest end of Coaster's Harbor Island is a peculiar dark gray or black rock made up of large grains of quartz firmly cemented together by metamorphic action. It is properly a coarse metamorphic sandstone or grit. The same rock forms the entire western part of Sachuest Neck, overlying the flinty slate of the eastern portion, and contains here and there small seams of black slate with coal plants—one of which is the *Annularia longifolia*. This rock occurs also at Conanicut on the east side of Mackerel Cove, where it rests upon the protogine and forms a triangular area. Its greatest thickness is about 750′. This is the lowest and earliest rock in this vicinity which upon palæontological grounds we can refer to the carboniferous period.

Apparently overlying this metamorphic sandstone we have in Mackerel Cove a mass of light and dark gray argillaceous schists, which cover the entire southern extension of Conanicut and extend as far north as Taylor's Point above Jamestown. These schists

The Geology of the Mouth of Narraganset Bay_ T. Nelson Dale.



The colors indicate both the Rocks exposed and those underlying Quaternary deposits, as far as determined.

N.^os I, II of uncertain Age. III, IV, V possibly Silurian.

VI, VII, VIII, IX Carboniferous.

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generally contain minute nodules of carbonate of iron (siderite). which when, oxidized, give the surface of the rock a striking appearance. Instead of siderite, iron pyrites in cubical crystals sometimes occurs. This series of beds is represented at the south end of Coaster's Harbor Island, and forms the southern part of Easton's Point. The veins which traverse these rocks often contain chlorite and sometimes also calcite and a little iron. The total thickness is 600′—2000′. At Easton's Point these argillytes are overlaid by the conglomerate with which we are all familiar, which is made up of pebbles of finely laminated quartzyte with some mica and contains *Lingulæ* (Brachiopod Mollusks.) This rock recurs at Paradise on both sides of the hornblende and mica schist beds, and along the east shore of the island from Smith's Beach to Black Point, and on the other side of the east passage at High Hill Point. There is some uncertainty as to whether the similar conglomerate, which forms the summit of Miantonomah Hill, and that which covers the greater part of Coaster's Harbor Island, and which differs considerably in its character from that of Easton's Point, etc., belong to the same age. The thickness is about 750′.

We have now examined the horizontal extent of the different beds and made what is called a geological map of the region. The next step is to ascertain the structure of these rock masses and their vertical relations to each other, so as to ascertain their relative age. We will not go through the wearisome details which this involves, but will satisfy ourselves with the results of much scientific drudgery. I will draw a line from the neighborhood of West Island, in a N. W. direction across our island, Conanicut and Dutch Islands, to the mainland on the west shore. This diagram represents a vertical section of the earth's surface along that line—or more exactly it combines the main features of a belt extending some distance on either side of such a line. The inclinations of the strata were either directly ascertained by measurement or else indirectly inferred. We shall now be able to arrange the beds in chronological order. The oldest rocks are the protogines and gneiss, etc., etc., etc. In the table they are numbered and arranged in that order beginning with the oldest. The rocks of the carboniferous period are Nos. 7-9. All those below No. 6 are of uncertain age. It is probable that some of them, as the hornblende and chlorite schists of Paradise, belong to the Silurian period but others probably are as ancient as the Archæan. The total thickness is from 8,250′—13,200′ which must represent a vast course of time.

But such a section not only enables us to arrive at the probable chronological order of the beds, but throws light upon the physical geography of the region in ancient geological times enabling us to conceive of the changes it has undergone and even to determine, with some approximation, the immediate causes of the present configuration of the bay. And these, the most interesting portions of our subject, we are now prepared to consider.

As I stated before, the lowest and oldest rocks in this part of the state are of sedimentary origin. The first geological fact in the history of the region indicates the presence of water, the sea probably, which formed the calcareous, aluminous, siliceous and magnesian deposits which, under metamorphism, became gneiss, protogine, mica, epidote, chlorite, hornblende and serpentine schist—that is beds Nos. 1-5. It is difficult to determine how far, if at all, these older strata had assumed a crystalline structure prior to the carboniferous period, as the whole series, including the carboniferous, evidently suffered metamorphism and flexure in late or past carboniferous times. It is also uncertain how far these older rocks had been disturbed when the carboniferous rocks were deposited, but from several indications it seems probable that the folds indicated in the section began to be formed in pre-carboniferous times, and that the chief outlines of our bay were determined at that remote period.

We may therefore conjecture that the nearest elevations on either side of the carboniferous deposits formed the shore of the swamps and estuaries of the carboniferous time. Such elevations occur at Barber's Height and Tower Hill, in North and South Kingstown and on the other side of the bay, in Tiverton and Little Compton. These southward trending ranges of protogine, gneiss, mica schist and chlorite slate bounded a bay or arm of the sea some 15 miles wide. In about the centre of the section you observe these masses of protogine and other pre-carboniferous rocks. While it is possible that they may once have been covered by carboniferous deposits which subsequent erosion may have carried away, I rather incline to the belief that these rocks were never covered in carboniferous times, but formed then an island around which such rocks were deposited. This island embraced the greater part of Newport Neck, the entire harbor, and a portion of Conanicut, and accordingly measured some four miles in diameter; so that as we ramble over the small hilly and rocky wilderness which characterizes portions of the Neck and of Conanicut, we may transport ourselves in imagination back to the time when in looking away our eyes would have rested on nothing but a shallow sea, or else upon great swamps crowded with the peculiar vegetation of the carboniferous time. The remainder of Conanicut and of our own island, excepting perhaps a small tract at its northern extremity and possibly another at Paradise, were not in existence; with these exceptions the nearest terra firma was at Tower Hill and Little Compton.

The carboniferous series, as before stated, consists of four groups of strata:—(1) the metamorphic grit, (2) the clay slates with carbonate of iron, (3) the quartzyte conglomerate, and (4) the slates, coal beds and fine conglomerates, which together constitute the coal measures proper. During the deposition of the two first and lowest of the series, there was nothing of a very exceptional character in the physical conditions of our bay. The fine quartz grains of the first deposit probably came from the erosion of some areas of granite or protogine. The presence of fossil plants in the layers of slate, which occur in this bed, indicates the neighborhood of marshes; and the abundance of iron carbonate in the succeeding bed shows the presence of carbon in the water and originally in the atmosphere. During these depositions, it is quite probable that that process of subsidence commenced which marked the period of the coal measures. This subsidence would affect the whole region, but, either owing to its taking the form of great folds, or owing to the greater elevation of the central island, would still leave that island above water. But during the time of the third group, the coarse conglomerate, we have evidence of an exceptional state of things. The great size of some of the boulders in the conglomerate at "Purgatory" and "Paradise" has been noticed by many. Some of these measure from four to nine feet in diameter.

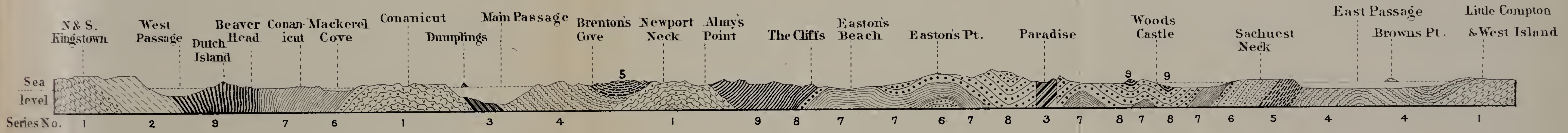
The following theories are held in regard to the origin of this conglomerate:—(1) that in carboniferous times, another glacial period covered this part of the continent with an ice sheet, and that these great accumulations of boulders were transported hither from distant ledges and left by the thawing ice. A serious objection to this theory is the fact that the boulders do not bear the scratches which characterize glacial boulders. Another theory is that the bay at that time was a gulf leading northwards into Arctic regions, and that icebergs, broken off from some Arctic glacier, floated southwards, and, thawing as they reached a warmer latitude, deposited their burden of pebbles and boulders here, just as they are doing to-day on the banks of Newfoundland. Another theory is that the place of these conglomerates was originally occupied by a finely stratified quartzyte or mica schist, formed during an earlier geological period and of marine origin, as indicated by the presence of the Brachiopoda, and that the action of the sea ground up the entire deposit into pebbles, by a process similar to that we see going on along our shores to-day. Still another theory is that a strong and swift river current opened in those times into the bay, and rolled the stones to their present place from some shore or hillside to the north. Each of these theories contains an element of probability. The large size of the boulders and the absence here of strata of their identical character are remarkable facts.

However that may be, after the formation of the conglomerate came a period of comparative tranquility, during which the "Coal Measures," measuring here some 2000′ were deposited. To account for alternating beds of coal, slate, and conglomerate, it is customary to suppose alternating periods of submergence and emergence. Under this theory the prospect from the Aquidneck Island of the carboniferous time must have greatly varied. There were long periods during which a supposed observer would have looked out only upon the broad arms of the bay, others during which his eyes would have rested, at least northward, northwestward, and northeastward, on a landscape bearing some resemblance to that of the Dismal Swamp of Virginia or the Everglades of Florida, and such periods recurred alternately.

During the close of the carboniferous period, changes of a

Section of the Mouth of Narraganset Bay_ T. Nelson Dale.

Horizontal Scale $\frac{1}{80,000}$, Vertical $\frac{1}{12,000}$. Total length 15½ Miles.



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more radical though perhaps gradual character set in. The submergence of the beds having reached its limit, the beds were powerfully compressed in a lateral direction, folded, tilted, faulted and fissured. This compressure is generally attributed to the disturbance of the rocky envelope of the earth following upon the cooling and contraction of its molten interior. At the same time, if not due to the same cause, the rocks assumed a crystalline structure, the beds of carbonaceous vegetation, then probably resembling lignite or hardened peat, were changed into plumbaginous anthracite. The beds of clay in places became mica schist, the conglomerate was compacted, and its pebbles arranged in parallel order, and the underlying older rocks became still more crystalline in character. The fissures throughout the series became filled with veins of quartz. Numerous observations prove that this pressure came chiefly from two directions :—One W. NW. —E. SE., the other at right angles N. NE.—S. SW., the former producing the great folds tending N. NE.—S. SW. parallel to the Appalachian range which was formed at this time, the other producing a series of minor folds and fissures trending W. NW. —E. SE.

The folded strata were brought above water and the main outlines of the bay and of our island were formed. The surface thus exposed suffered erosion by the rivers, tides and rains during a great lapse of time, until the glacial period set in, when they were subjected to still greater changes at the hands of the ice sheet, which by means of its enormous weight, and the stones and boulders frozen into its under surface, plowed out hollows, shattered and broke off rock masses, furrowed, grooved and polished all the surfaces which withstood its southward march. During the thawing of the glacier, a depression of the land took place followed by an elevation of 40′ to 50′. To the action of the ice sheet and of the great stream to which it gave rise as it thawed, the final configuration of our bay and islands is mainly due. This becomes apparent in examining a section of the bay, for the depressions do not always correspond to the depressions in the folds of the strata. The folds have been cut into. How much of this is due to the preglacial erosion is uncertain. The most notable instances of these influences are seen between High Hill Point and

Black Point in Seaconnet river and at the "Paradise" ridges. The recess between Easton's Point and Sachuest Point was thus formed; that between the Cliffs and Easton's Point, and also the hollow occupied by Easton's Pond, Brenton's Cove, and the depression between the chloritic slates and the flinty slates on the Neck, the passage between Conanicut and Fort Adams and the harbor, Mackerel cove in Conanicut, and the passages on either side of Dutch Island, all are due to the same causes.

A few things remain to be noticed. As the ice sheet thawed it deposited its load of clay, sand and boulders, all over our region, but very unequally. In this vicinity the morainal matter is not very thick, but near Providence it forms considerable hills and plateaus. But we received our share of the boulders as every builder, farmer, gardener or pedestrian knows. Much of this morainal matter was deposited in the sea, and this, together with what has since been carried thither by streams or formed by the wear and tear of the waves, the sea has, in part at least, thrown back upon the shore in the form of sand bars and beaches. Then the wind coming to the aid of the waves piled up the sand in drifts back of the beaches, damming up the outlets to small streams and forming ponds which are gradually transformed into marshes. In this way the recesses in the coast are filled out and the shore is becoming more rounded in outline.

As we study a map of our bay with the knowledge of these geological facts, its features begin to brighten with a significance, which will materially enhance our enjoyment of the picturesque scenery which surrounds us.

ALASKA.

By J. B. PARKER, M. D.,* Surgeon U. S. Navy.

Our subject, Alaska, is not a popular one, and consequently not often referred to. Much indifference prevails concerning it, yet for many years it has been the most extensive of our territorial possessions. This indifference is due, we think, to an impression that it is destitute of the resources necessary for civilized man.

Alaska has been mentioned more frequently during the past year than during many preceding years; and this is due to the fact that Congress has recently considered and finally authorized a civil government for the Territory. As a result of this new government we may expect more scientific knowledge of its resources during the next few years than we have gained since its acquisition.

It is necessary to state that the paper I will read was not prepared for this occasion, and was intended as a word in defense of the Territory against the charge of utter worthlessness. It is hoped it may not be entirely devoid of interest.

Our chart is the latest issue of the United States Coast Survey office and contains the geography of the Territory so far as known. It is evident from the extensive blank spaces, apart from the coast and here and there along the Yukon River, that we have much to learn of the interior.

The boundary line between Alaska and British America north of Mt. St. Elias is the 141st meridian of longitude. From Mt. St. Elias its general direction is south and east to nearly the 130th meridian, and embraces a small portion of the mainland and the large group of islands known as the Alexandria Archipelago.

Much of the Territory is volcanic and contains many peaks in a partial state of eruption or giving evidence of recent action. It contains three ranges of mountains—the Coast, Rocky and Alaskan Mountains, the last being an offshoot of the Rocky Mountains.

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*Read before the Society July 3d, 1884.

An interesting feature connected with the Coast range is the occasional presence of glaciers in the mountain gorges. Generally they are not of great magnitude, but an exception occurs in the vicinity of Mt. Crillon where may be seen a glacier apparently several miles in breadth and many hundred feet in thickness. From the sea it is an unusually interesting sight.

For convenience of description the Territory is divided into three districts—the Yukon, Aleutian and Sitka districts. The Yukon district is that large portion of the Territory north of the Alaskan Mountains, west of the boundary line, south of the Arctic Ocean and east of Behring Sea and Strait.

The Aleutian district includes the Alaskan Mountains and the peninsula with its numerous islands extending south and west.

The Sitka district is the remaining portion of the Territory extending south and east.

The object of greatest interest in Alaska proper is the Yukon River, whose magnitude has invariably increased with the report of each successive explorer. It is now believed to be the third or fourth great river of the world. It has its origin in lakes and tributaries in British America north of the Sitka district, from which point it can be entered and descended to its mouth in Norton Sound.

Other large rivers are the Stikine, Chilkat, Copper, Sushitna, Nushagak, Colville, Porcupine, Pelly and Kuskokwim, the last being next in size to the Yukon.

The following public announcement by one of our most distinguished citizens may with probability be regarded as expressing the sentiment of a majority of our people: "The Territory of Alaska is the most worthless of our possessions and has served no other purpose than to satisfy an unreasonable desire for empire." Let us glance at such information respecting our much neglected territorial extension as we possess and can be embraced in a paper of this length, before accepting as altogether just the above severe and emphatic denunciation. If the Territory of Alaska is prejudged, and our impressions change with contact and development, it will not be the first instance in the history of this and other countries. That deception of this character has occurred, it is only necessary to recall that it is recorded as a statement in

Congress, about 1847, that the Rocky Mountains would be the limit of railroad extension across our Continent; that the barrier presented by these mountains and the extensive desert tract beyond must prevent the development of the now Pacific States. If we compare our present and past knowledge of Africa, we are again surprised that we could have been so deceived. In Africa, not many years ago, it was to die of pestilential fevers, or by the hand of the black assassin, if the ferocious beast was escaped; now, it is to freeze or starve in Alaska.

Our scientific knowledge of the Territory is comparatively little, and has not much increased since its purchase seventeen years ago. For the information of this character now in our possession relating to its geography, productions and climate, we are chiefly indebted to the director of the Scientific Corps of the Western Union Telegraph Expedition. For other valuable information we are indebted to adventurous traders and miners, whose intimate social relations with the natives, in many cases, gain for them a knowledge not quickly acquired by others. Such information as has been gained through the United States Signal Station at Point Barrow and the late military reconnoissance has not yet been officially promulgated.

The most recent (July, 1883) and perhaps important discovery, since the acquisition of the Territory, is that of a river, emptying into Hotham Inlet, three-quarters of a mile wide near its mouth, and from two and a half to seven fathoms deep. From information obtained from the natives it is thought to be three or four hundred miles long, and to connect, after a short portage, with a second unknown river flowing north into the Arctic Ocean. The discoverer will soon explore this river and his report, which may embrace other valuable information, will be awaited with much interest. The river was ascended about fifty miles, and it may be noted here that the report of the explorer states: "Everywhere the natives were kind, harmless and hospitable, many of them evidently having never seen a white man before. The heat was intense, vegetation rank, and the natives scantily clad."

The attempt of the Western Union Telegraph Company, in 1866, to build a telegraph line through Oregon, Washington Territory, British Columbia and Alaska, thence by cable across Behring

Strait into Siberia, to connect with the Russian telegraph lines extending east from St. Petersburg to the mouth of the Amoor, a distance of six thousand miles, is now an interesting item of history. The expedition, it will be remembered, was abandoned, after years of toil and an outlay of three million dollars, on learning of the completion and success of the Atlantic Cable, but not before it had reached Sitka (?), Alaska, a distance overland of about sixteen hundred miles. The liberal manner in which this expedition was conducted by the Telegraph Company, whose intelligent directors appreciated the advantages to be gained through a better knowledge of the Territory, enabled the scientist of the expedition, and those associated with him, to prosecute an exploration of scientific value to the country, as well as practical advantage to the Company.

An idea of the magnitude of this extreme northwestern and isolated Territory can only be obtained by comparing its area with other and better known countries, when we will find that it contains as many square miles as England, Ireland, Scotland, Wales, France, Spain, Portugal, Switzerland and Belgium combined, and, in our own country, is as large as the united areas of our five largest states, viz: New York, Pennsylvania, Ohio, California and Texas. It contains over sixty known volcanic peaks, three of the largest mountains in North America (Mount St. Elias, nineteen thousand feet, being the loftiest), a sea-coast covered in part with forests of choice timber, thousands of islands, good harbors on the sea-coast, still better in its numerous and extensive channels, sounds and bays, and a river, the Yukon, which now takes rank with the four largest in the world, "equalling the Plata, and surpassed only by the Amazon and the Mississippi." This great river, flowing through the interior and finally reaching Behring Strait, is estimated to be two thousand miles long, and with its tributary, the Pelly River, nearly three thousand. It is twenty miles wide as you approach its mouth, seventy at its mouth, and is now known to be navigable for river steamers, eighteen hundred miles. Of the five hundred and eighty thousand square miles in the Territory, more than one half, or about three hundred thousand square miles, are thought capable of cultivation. It is then difficult to believe that Alaska, with this vast extent of territory, this majestic river and tributaries, with these lofty mountains, capacious harbors and numerous islands, is of no greater value than to supply the wants of a small Indian population and afford a resting place for wild animals and birds.

An examination of the resources of the country during its present neglected condition may lead us to hope that a nobler mission awaits it when better known and appreciated by government and people.

In 1867 the United States, through the agency of the Honorable Mr. Seward, then Secretary of State, purchased from the Russians all their Alaska possessions for seven million, two hundred thousand dollars. An unlooked-for enterprise of this character on the part of the government, which was to deplete our Treasury so largely (?), was met with opposition, censure and ridicule. Nor did it end here, for, in addition to the charge of unwarranted extravagance, hostility to tax-payers, conniving with Russians, the government was adjudged quite insane, and thought incapable of future legislative and executive acts tending to our prosperity. The continued assurance of Mr. Seward, however, that the purchase was wise,—necessitated, in fact, by its proximity to the United States,—and that we were only placing our money at interest, induced us finally to accede to the proposition, and, looking to the future needs of our country, to accept his declarations as superior wisdom.

Have we occasion to regret the purchase when we consider the small sum expended for so vast a territory, and the fact that two of its smallest islands (St. Paul and St. George), only a few miles in circumference, have not failed, and will probably never fail, to pay us yearly a good interest on the money invested, and for which the Russian Fur Company paid annually to the Russian Crown three hundred thousand rubles?

The fur-seal fishery at these remote islands in Behring Sea, known as the Pribyloff group, is the leading industry and the chief source of the supply of superior skins. It is thought a modest estimate that, prior to our possession, these islands furnished from three hundred to five hundred thousand skins annually; and on one occasion, it is said, the Russians destroyed three hundred thousand to prevent the market being overstocked. This whole-sale destruction and the fear of final extinction led our government, in its lease to the Alaska Commercial Company, to limit the annual capture to one hundred thousand, which continues the authorized limit. It has been suggested, however, that if an additional fifty thousand were added, it would not more than comprise the number actually destroyed by authorized and unauthorized agents.

The strange instinct of the seal to return yearly in such numbers to be slaughtered is a mystery not easily explained. Cruelty and the destruction of millions during the past one hundred years do not appear to have disturbed their affection for these islands, but, on the contrary, appear to have caused greater persistency in claiming and perpetuating their ancestral homes. In a recent report to the Honorable Secretary of the Treasury it is stated that the number of these annual visitors is increasing rather than diminishing. "The grand total of fur-seal life in 1873, upon actual inspection, is believed to be represented by more than four million, seven hundred thousand, and it is estimated one million young seals are born on the Seal Islands every year." In eleven years the United States Treasury has received a revenue from these islands of three million, four hundred and fifty-two thousand, four hundred and eight dollars and fifty cents.

Second in importance to the seal, competing with it only in the quality of its fur, more highly prized, and exceeding it greatly in value, is the sea-otter. Originally, we are told, the sea-otter fishery was a more important and valuable trade than the seal fishery; but increasing scarcity of the otter and greater difficulty in its capture have led to an abandonment of this enterprise to a great extent. Though reduced in importance, it is not extinct, as an annual capture of several thousand indicates. The third branch of the fur trade active in Alaska includes the land fur-bearing animals. The revenue from this source is also very great, and, in the aggregate, may quite equal those just mentioned. As an indication of the yield of the forests in fur, we refer to the supply of a few only. In past years it is observed that the Territory has furnished annually fifty-seven thousand beaver skins, eighteen thousand land-otter, of five varieties of foxes seventy-one thousand, and of muskrats two hundred and twenty-one thousand.

All are familiar with the American whale fishery in Alaskan waters, and the wealth derived by our people therefrom. Though less remunerative than formerly, it is carried on with vigor and success, which may be partly due to the fact that the whaler need no longer lose time, or perhaps season, in seeking an American or friendly port in which to make needed repairs, if such can be accomplished in the waters of the Territory, a privilege which was denied him while Russia was the owner. The benefit derived by the transfer of the Territory in this particular instance alone cannot be doubted.

Of equal importance is the revenue derived from myriads of smaller fishes inhabiting the banks and inland waters. Conceivable numbers fail to estimate them. They include the cod, salmon, halibut, herring, and ulikon as the principal. For an illustration of the character of this supply, we refer to the records of the California fishermen during 1867-68-69, where we find that in the year first mentioned two thousand, one hundred and sixty-four tons of cod, or nine hundred and forty-seven thousand, two hundred and sixty-four fish, were caught in these waters; the next year the market was overstocked, and over four hundred and seventy hundredweight were exported from San Francisco to New York; and the following year, one million, eight hundred and eighty-two thousand is recorded as the number imported into San Francisco. Three thousand tons were caught in 1879 for houses in San Francisco, and the catch for 1880 is stated, in a recent report to the Honorable Secretary of the Treasury, as six hundred thousand for a single firm in San Francisco.

During late years, the acknowledged variety and superior quality of the salmon has led to the establishment of numerous factories for canning or salting this fish in the waters of British Columbia and Alaska, and, it is needless to say, with immense profit for all concerned. It is probable that a good proportion of this article now offered for sale is the product of these factories, whose supply is often greater than the demand. The fishing season is in June, and it is at this season that the harvest in salmon is reaped. They offer themselves in such numbers that little difficulty and no excitement attend the catch. For their own use the Indians often wade into the streams and kill them with spears or clubs. At other times, a greater quantity being required, as for canning or salting, a net is used, or a wheel with canvas paddles is made to revolve in the stream, when the fish are lifted from the water with every revolution. Herring and other small fish are caught by the Indians with great rapidity on sharpened nails driven through a lath, by beating the water or quietly passing the lath to a depth of several feet, and then, with a sweep, raising it quickly; generally a fish is found pierced by every nail. Indeed, the waters of Alaska voluntarily give up their fish as those who have visited Sitka have observed, the beach there being often strewn after fall of the tide with a beautiful little fish not unlike our young pollock. When required by the natives and others for immediate use they are gathered in buckets; but generally the supply is so excessive they are left to decompose upon the beach, when the voracious crow has grown stupid from repletion.

The ulikon is a fish of special interest, peculiar to the Pacific and destined to enjoy a reputation for usefulness to man equal to that of the cod. It is about fourteen inches long, and in general appearance resembles smelt. This fish supplies much of the oil used by the natives. It is said alcohol will not preserve them, owing to the excess of oil. When dried, they serve as tapers for the natives, for which reason they are often referred to in Alaska as candle fish. The refined oil is as clear, not more disagreeable, and, we believe, will prove as beneficial in certain diseases as our much esteemed cod-liver oil, for which it is substituted by whites in Alaska. Should the supply of cod-liver oil in the future be diminished, ulikon oil will be an important industry. This fish is so abundant in the Nasse River that the water is said, during the run, to appear to boil from their rapid motion. At such times they are the prey of bird and beast, the latter lifting them without difficulty from the water with their paws. The present neglect to further utilize this superior oil and establish whale fisheries, including the black and other large fish in the sounds and channels of Alaska, may be regarded as preliminary to greater activity eventually. Shell-fish, save our favorite oyster, are also to be obtained. The oyster, as is known, is found at few points on the North Pacific coast, and then of an inferior quality.

Limited scientific research in Alaska has recognized and classified seventy-seven different kinds of mammals, thirty-five of fishes, one hundred and ninety-two of birds, and fifty-three of insects, many of them prior to 1867 unknown to science. That this list will be extended upon additional investigation there is little doubt. Congress has been asked to authorize the expenditure of a sum of money to enable further study, but as yet it has not regarded the request favorably. Volunteers possessing the requisite zeal and talent necessary to prosecute a work of this character have not been wanting, and at this time are not without hope that the subject will be regarded with favor by Congress at an early day, from the fact that very recently the United States Senate has approved a bill authorizing a Territorial government for Alaska, hesitatingly, it is true, and only of a tentative character. In any event the friends of the Territory can now feel that the results of this new and first government provided by the United States will be gratifying to Congress, and lead to further important legislation in her interests.

In the quantity and quality of her timber, Alaska is thought to rival California, Oregon and Washington Territory, and to hold in reserve a supply of this article for an indefinite period, when the forests of the last mentioned places have been exhausted and perhaps forgotten. The visitor who has observed several saw-mills in operation on the waters of British Columbia and in the Territory, and the numerous slides for timber from the summits of the elevated peaks, may not feel so confident as to the duration of Alaska forests. At a number of points timber was sawn in steam-mills and transported to San Francisco, where it is prized for ship-building among other uses. The most highly prized are hemlock, pine and cedar, though there are other useful woods. The mountainous character of the coast, the absence of roads and facilities for transporting the timber when it cannot be rolled into the water, greatly retard the activity of this industry, and in some instances have caused it to languish.

There is reason for the impression that gold exists extensively in the Territory, and for certain active mining operations connected therewith. At Auk, an Indian village on an inland arm of the sea, placer and quartz-mining have been going on for a number of years during the summer months. As to the results, it is only necessary to state that the yield the first summer was thirty thousand dollars, and that the number of miners at this point has increased each year, and now reaches hundreds. From personal observations at Auk, and information received from the officers of the monthly steamer, it is known that much gold has already being obtained. Inability to continue mining operations during the winter, absence of capital, and distant transportation of necessary working materials for quartz-mining have only *retarded* the industry. Prior to 1882 mining at this point was chiefly placer; but the expected arrival of a stamping-mill for quartz-mining has probably produced results agreeable to the most hopeful. A discharged United States soldier, a resident of Sitka, in 1881 was the possessor of a gold mine located fifteen or twenty miles distant. An examination of the quartz impressed us with its value. It was discovered by the owner shortly after the transfer of the Territory, while serving as an enlisted man at Sitka, a small force of United States troops being maintained there at that time. The ex-soldier lamented his inability, for want of capital, to work the mine more extensively, but stated that, notwithstanding his primitive means for crushing the quartz, necessarily attended with great labor, he could, with the aid of a son and trusty Indian, obtain, when industrious, about fifteen hundred dollars in gold each year. Prospectors claim the existence of gold at other points.

Among other industries is the American-Russian Ice Company, at Kodiak, where it has extensive ice houses, which are kept filled, yet no shipments are made. It was once engaged in profitable trade, but recently has accepted the proposition of San Francisco companies not to enter into competition with them.

Coal has been found at different places along the coast, but ignorance prevails as to its quality, the surface coal only having been examined. So far as experimented with, the results have been satisfactory, and justify early and thorough investigation. "Copper and petroleum have been discovered on Copper River; lead on Whale Bay and in Kodiak Island; iron and graphite in many places; marble and sulphur in large quantities; bismuth in Vostovia Mountain; and kaolin, fireclay, gypsum, amethysts, zeolites, garnets, agates, carnelians and fossil ivory are also found."

Maritime industry has received attention. At Wooded Island the natives could boast of a twenty-ton schooner, built by their own hands with wood from their own forests. At Kodiak five small vessels were owned, and sailed as coasters from this port. The revenue steamer "Rush" in a single summer boarded thirty-five trading vessels in Alaskan waters. The Alaska Commercial Company employed a fleet of four steamers and twelve or fifteen sailing vessels for trading in various parts of the Territory. The Northwestern Trading Company had also a number of trading posts, and employed several small vessels in their trade with the natives.

At a point not distant from Sitka and in the Aleutian Islands are found mineral and hot springs surpassed by few, if any, in the United States. The tonic and alterative properties of the first were tested by several white residents, and highly commended. Others extolled their virtues in constitutional diseases of a specific character.

Alaska's geographical position—her whole northern coast bordering the Arctic Ocean—would seem to forbid that fertility of soil so essential to wealth and permanency of population, and appears to justify a not unusual impression that the Territory is almost a desolate and frozen waste. That the climate has been the great impediment to early and rapid development cannot be questioned, but that the Territory throughout is destitute is denied. In a Territory so vast, extending in latitude due north and south fourteen hundred miles, and in longitude nearly forty degrees, or about two thousand, two hundred miles—a variety of climate must prevail; hence deception ensues if the meteorology of one section is accepted as applicable to another remotely situated. Not until the cold of Alaska has abated and its rainfall diminished can we expect it to be voluntarily selected as the permanent home of wealth and culture; but, in the meantime, it is more than probable that capital and labor will expand her industries, and be well rewarded with her now justly suspected treasures. Then may additional factories and mills be established at suitable places, and the Territory become the home, temporarily at least, of the laborer and skilled worker in metals and woods.

A curious discrepancy is observed in the statements, oral and published, regarding the probable capability of the soil to produce agricultural products. By one we are informed that the character of the climate is such that resources of this nature must fail, or, at most, permit nothing more than a bare existence for civilized man. By another we are told that Alaska may some day furnish California with certain agricultural products. How is this difference of opinion to be explained? In the one case it appears to be the impression of the casual visitor for a limited season at certain coast ports, and at a particular season; in the other the conviction of a man of science, who has explored, with great labor, much of the interior of the Territory, and can add this knowledge to his previous knowledge of the coast. Then until further scientific investigation exposes the errors of the past, we must respect the teaching of our only Alaska scientist, whose merits were fully appreciated and recognized by the Smithsonian Institute at Washington. In his report to the Commissioner of Agriculture in 1868 the following relating to agriculture appears:

"Grain has never been sown on a large scale in the Yukon district. Barley, I was informed, had once or twice been tried at Fort Yukon in small patches, and the grain had matured, though the straw was very short. The experiments were never carried any further, however, the traders being obliged to devote all their energies to the collection of furs. No grain had ever been sown by the Russians at any of the posts. In the fall of 1867 I shook out an old bag, purchased from the Russians, which contained a handful of mouse-eaten grain, probably wheat. The succeeding spring, on examining the locality, quite a number of blades appeared; and when I left Nulato, June 2d, they were two or three inches high and growing rapidly. As I did not return, I cannot say what the result was. Turnips and radishes always flourished extremely well at St. Michaels, and the same is said of Nulato and Fort Yukon. Potatoes succeeded at Fort Yukon, though the tubers were small. They were regularly planted for several years until the seed was lost by freezing during the winter. Salad was successful, but cabbages would not head. The white round turnips, grown at St. Michaels, were the best I ever saw anywhere, and very large, many of them weighing five or six pounds."

"The treeless coasts of the Yukon territory are covered, as well as the lowlands of the Yukon, with a most luxuriant growth of grass and flowers. Among the more valuable of these grasses (of which some thirty species are known to exist in this district) is the well-known Kentucky blue grass, which grows luxuriantly as far north as Kotzebue Sound, and perhaps to Point Barrow. The wood-meadow grass also reaches the latitude of Kotzebue Sound, and grows on the coast of Norton Sound with a truly surprising luxuriance, reaching, in very favorable localities, from four to even five feet in height, and averaging at least three. Many other grasses enumerated in the list of useful plants grow abundantly, and contribute largely to the whole amount of herbage. Two species almost deceive the traveler with the aspect of a grain field, maturing a perceptible kernel, which the field-mice lay up in store."

"I see no reason why cattle, with proper winter protection, might not be successfully kept in most parts of the Yukon district. Fodder, as previously shown, is abundant. The wild sheep, moose and reindeer abound and find no want of food. A cow did well at Fort Yukon for a time, but was accidentally killed by falling into the river. It will be remembered that Fort Yukon is in latitude 66°, north of the Arctic Circle, and the most northern point in Alaska inhabited by white men."

"Small fruits are found there in the greatest abundance. Among them may be noted red and black currants, gooseberries, cranberries, raspberries, thimbleberries, salmonberries, blueberries, bearberries, dewberries, heathberries, mooseberries and roseberries. All these berries are excellent, especially the salmonberry."

"Summary: While in the Yukon district we cannot look for self-supporting agricultural departments, nor reasonably expect any one to obtain a sustenance by farming alone, still the settler called there to develop the resources of the country, be they lumber, fish or furs, may have milk in his tea and many vegetables on his table, if he possesses the energy and knowledge to make the most of his opportunities. It will not be necessary for him to rely on the products of the chase alone, if he will but take the necessary care to provide shelter for his cattle, and to cut the perennial grasses which cover the prairies and lowlands for their fodder during the winter."

"The climate of the Aleutian Islands is moist and warm; the greatest cold recorded in five years was zero of Fahrenheit, and this occurred only once. The greatest height of the mercury was 77° F. The grasses in this climate, warmer than that of the Yukon district and drier than the Sitka district, attain an unwonted luxuriance. For example, Oonalaska abounds in grasses, with a climate better adapted for haying than that of the coast of Oregon. The cattle were remarkably fat, and the beef very tender and delicate, rarely surpassed by any well-fed stock. Milk was abundant. A remarkably rich and genial soil, arable and well suited for garden and root-crop culture, lies near the coast. It occurs to us that many choice sunny hillsides would produce crops under the thrifty hand of enterprise. They are already cleared for the plow. Where grain-like grasses grow and mature well, it seems fair to infer that oats and barley would thrive, provided they were fall-sown. Several of these grasses had already (September) matured and cast their seed before we arrived, showing sufficient length of season. Russians affirm that potatoes are cultivated in almost every Aleutian village, and at one village the seed has been preserved for planting since the beginning of the century. The climate is as mild as that of the Highlands of Scotland, or the Orkneys, where stock has been successfully kept from time immemorial."

"Summary: In the Aleutian district is situated the larger proportion of arable lands, and in this and the northern part of the Sitkan district the climatic conditions are the most favorable in the Territory. Oats and barley, probably wheat and rye, may succeed on these islands. Their abundant capacity for producing root-crops of good quality, except possibly potatoes, may be considered as settled. That cattle will do well there is no doubt, *and the Pacific coast may yet derive its best butter and cheese from the Aleutian and Northern Sitkan districts.* Sheep, goats and swine have not been thoroughly tried as yet, but the inference is that they also would succeed."

"The resources of the Sitkan district lie apparently in its lumber. To the northern part of this district the remarks on the Aleutian district will apply."

The capacity of Sitka to produce a variety of garden vegetables was abundantly demonstrated in 1881 by an ex-sailor, who gained a comfortable livelihood by the sale of these products grown in his own garden.

The rainfall and fog, though prevailing more frequently off the southern coast of Alaska, is not peculiar to that region, as the same condition exists as far south as Mexico. The effect of the warm atmosphere engendered by the waters of the Pacific Ocean and Japan currents coming in contact with the colder atmosphere of the Coast Mountains, in producing a condensation similar to that produced by the waters of the Atlantic off the British Islands, is familiar to all. Owing to this almost perpetual saturation of the atmosphere, rubber boots and oiled jackets become a necessary part of the outfit of the Alaska miner and fisherman. The rainfall in Southern Alaska is generally of short duration and frequent. It is quickly absorbed by the earth and in a few hours is forgotten. Several falls of rain during the day, with intervals of cloudless sky, are not infrequent.

In November the peaks of the Coast Mountains whiten with snow, which gradually descends their sides as winter advances, until finally the mountains are completely enveloped. A truly Arctic scene is presented to the voyager at this time and it is probable he will experience feelings of awe, loneliness and desolation. In the spring the mountains are as gradually uncovered, until an elevation of about one thousand feet is reached, where the snow may linger a month or two later, and at still greater heights remain during the entire summer. Along the coast in Southern Alaska the snow which reaches the surface is probably not greater than the fall during an ordinary winter in our New England states and disappears as quickly. In the interior the fall of snow is greater. North of the mountains or from thirty to fifty miles from the coast, snow to the depth of several feet covers the earth for nearly, if not quite, half the year. Yet at Fort Yukon, about the centre of the Territory, the heat at times during the summer is said to be oppressive, and the mercury has been known to reach 112° F. By reference to such meteoric records as we possess, it is learned that the mean summer temperature at Fort Yukon is 59.67°; for autumn, 17.37°; spring, 14.22°; winter, 23.80°; mean yearly temperature, 16.92°. In the Aleutian and

Sitkan district, however, the mean annual temperature is thought to be about 44° F.; winter, 33°. At Sitka the minimum temperature was one year 10° F.; maximum, 71°. It may be interesting to note that the mean winter temperature of Sitka and Newport, Rhode Island, are about the same and that there is only a difference of 6° in the mean yearly temperature, notwithstanding a difference of 16° in latitude. The mean annual temperature of the whole territory is roughly estimated to be about 25°, and it is remarked that the real opportunity for agriculture in a cold country cannot be deduced from annual mean temperature alone, but is dependent on the heat and duration of the summer months.

Geological changes affecting the temperature are thought to be active in Alaska, as shown by the diminishing size of the many glaciers formed in the mountain gorges. It is suggested by geologists that the peninsular portion of Alaska and Siberia are gradually being elevated, which suggests, in addition to climatic change, the possibility of a visit to Asia by rail.

The villages of Alaska are small and unimportant. Considered as to commercial importance and white population, they may rank as follows: Seal Islands, Kodiak, Sitka, Wrangel, Oonalaska, Belkovsky, St. Michaels and Auk, the last probably the most active during the summer on the arrival of the miners. The total civilized population in the Territory is about one thousand, which includes the Russians who have remained since the purchase. The total native American population is not more than a few hundred. The Indians, estimated a few years ago at seventy thousand, are reduced by the last census to thirty-three thousand.

The aborigines of the southern coast are said to be the most civilized in America, if the term civilized can be applied to an Indian. They are not nomadic, and have comfortable dwellings in villages of from one to three thousand inhabitants on the rivers and inland arms of the sea. Their dwellings are constructed with logs or sawn lumber, and are thirty to forty feet square, twelve to fifteen feet high, with sloping roofs. At a distance their settlements are not unpleasing, especially when the buildings are whitewashed, as was required by the local authority, and recall the appearance of an early western frontier settlement. The interiors of the houses are equally simple in architectural design, consisting of a central fireplace on the ground and a slightly elevated walk on one or more sides, which is used for sleeping, and is usually sufficiently large to accommodate a family, which consists often of twenty or thirty persons. In appearance the Indians are copper-color, the shade increasing or diminishing with location, and of fine physique, save in those instances where the habit of prolonged sitting in a canoe, as in fishing, has prevented the development of the lower limbs.

The coast and interior Indians of southeastern Alaska are not on friendly terms. The interior tribes, less numerous and warlike, complain that the coast Indians will not permit them to trade directly with the whites. When accomplished surreptitiously, it is at the risk of punishment if discovered. Prospectors who have passed months in the interior state that the interior, or "Stick" Indians, as they are called, are inoffensive. The coast tribes are warriors, and have frequently engaged each other in fierce and protracted wars, on what would appear to us very slight provocation. Usually, however, their quarrels are not long continued, if the conflict at first has been sufficiently decisive to indicate the probable result. Terms of peace can often be quickly arranged, on the basis of indemnity to the friends of the killed and wounded, which is generally the payment of a certain number of blankets, previously agreed upon. The wealth of an Indian or tribe is determined by the number of blankets possessed.

Their relations with the whites are not always friendly, and in these rather exceptional instances their hostility can often be traced to some real or imaginary wrong inflicted by the whites. As a rule, the natives do well, and if they could be entirely deprived of alcoholic drinks, and the whites would treat them more kindly, the few assassinations at the hands of the Indians would be still further reduced. To this there are exceptions, and there will be as long as the Indian feels that the white man and all he possesses within the Territory is his lawful prey. The treachery of the Indian, then must not be overlooked under any circumstances, as the following instance which occurred some years ago, will show. A schooner, having on board a captain and two miners, entered Yakutat Bay, about one hundred miles to the westward of Sitka, with the view of prospecting for gold. The wife of the captain was an Indian woman, and a native of the village off which they were anchored. She and her mother were also on board. A young Indian, supposed to be reliable, was selected as guide, who, after assisting the miners in landing their provisions, conducted them to the suburbs, where, after treacherously separating them, he seized their arms, and, in turn, brutally slew them with blows upon the head from the butts of their guns. Feeling that he had committed no crime, he at once admitted the murders to the family of the captain, and stated his object was the capture of their provisions and guns. Two years later an American man-of-war entered the harbor in pursuit of the murderer. Two Indian chiefs were taken on board and the object of the visit explained to them. One was allowed to depart in search of the murderer, who had fled to the mountains; the other was retained on board as a hostage. In two days the chief who was permitted to depart returned with the murderer, who was at once recognized by the captain and family of the schooner mentioned, and who were brought by the man-of-war for that purpose. When the murderer found himself securely on board, he very calmly described the character of death he preferred, accepting it as certain and immediate. In this respect he was disappointed, and was sent for trial to the nearest United States court, which was Washington Territory, where he was convicted and promptly executed.

The stolid apathy asserted of the Indian was not observed in the case just mentioned. Among the many canoes which hurried to and from the man-of-war on that sunny November morning —made doubly bright from reflection on the lofty and snowy peak of Mount St. Elias—was observed one in particular containing two Indian women, with head *bowed* and *weeping*, of comely appearance and exceptionally neat in attire: they were the mother and sister of the murderer.

Courts, laws, and lawyers are unknown in Alaska, nor does a civil officer of any kind exist.* Legally, an oath cannot be administered, debt collected, or property transferred. Such authority as prevails is military, and is vested in the commander of such United States naval or revenue vessel as may happen to be present. Instructions from the government direct the Commander of the man-of-war to prevent crime and preserve peace among whites and Indians. He is authorized to arrest, fine, and imprison for a certain period in minor offenses, but all capital offenses must be transferred to the nearest United States court for trial. The manufacture of any kind of liquor, its introduction, or the introduction of materials from which it could be made, such as sugar, molasses, etc., except to authorized merchants, are forbidden. The Indians have learned from the whites the process of distilling intoxicating drinks, and with an ordinary tin can and worm, the latter made of a sea plant, find little difficulty in supplying their alcoholic wants, if the material with which to make it is at hand.

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* This condition of affairs no longer exists, an Act providing a civil government for Alaska having been approved May 17th, 1884, and appointments made in accordance with its provisions.

Alaska has found one friend in the United States which continues faithful—the Missionary. With a view to the early evangelism of the Indians an American Mission was established soon after the purchase of the Territory. Such religious teaching as the Indians in Southern Alaska have received, prior to the establishment of the American Mission, was in the Greek Church at Sitka and Kodiak, remnants of which exist at these places. During the past few years five stations have been established by the mission above referred to on the waters of the Alexandria Archipelago, remotely situated, and with a result encouraging to the most despairing. The success of the schools it has established at Sitka and Wrangel for the Christian education of Indian boys and girls, with instruction in practical duties also, is now, after years of labor, considered settled. Each year these institutions have yielded better and more mature fruit, a result surely gratifying to us, but not to be compared with that experienced by the earnest and pious men and women engaged in this noble work. In instance of the devotion of these good people, it may not be amiss to state that the last and most northern mission established in Alaska was on Lynn Channel, at the head of inland navigation, where is located a large village of Chilcat Indians, who are considered the most savage in the Territory. At the mission here was found a Pennsylvania lady of wealth and culture and extremely delicate physique, occupying a few rooms, with no other companionship than her husband, infant and a white trader. Fifty miles distant was the next mission, where resided her nearest white neighbor, and which could only be reached by Indian canoe during the long winter. In answer to an inquiry why she had subjected herself to such a rigorous winter climate, she replied: ''My health is impaired because of a probably fatal malady, and I feel that my years on earth may be few. I wished to devote the strength I still possess to God's service, and I have selected this as most pleasing to Him." Under such influence alone there must be a future of importance for Alaska, and we can look for a result at least similar to that obtained at an Indian settlement in British Columbia, where, under the guidance of an English missionary, the Indians not only support their own churches, but send missionaries to their people elsewhere, and produce everything necessary to life. It is probable then that the churches of America will pioneer the way to just recognition of Alaska, and may eventually place her in public estimation as the peer of now more respected and worthier states and territories.

AN AQUARIUM; NEWPORT'S NEED.

By G. G. KING.*

The City of Newport, as a summer resort, has a distinctive character which it can never lose. Held in place by broad arms of the sea, and with the ocean lapping its feet, with harbor lines restful in their beauty, with hill and dale diversifying its surface, and with long, gracefully curving beaches where the waters love to play, it has charms for every taste and secures variety for every mind. These charms and this variety have long been recognized as special to this place. Once remarkable for its commerce, it is now famous for its beauty, its healthfulness, and convenience as a summer resort. Hither has come much of the wealth and education of our country. The result of this influx has naturally been in the improvement of the houses and of their longer occupation; so that, instead of a residence of two months, the so called cottage inhabitants remain five or six months of the year. The conveniences which these houses afford begin to tempt many to spend most of their year here. So true is this, that it seems probable that within a few years, Newport may be as well known as a winter resort, as it now is famous as a summer one. With this growth of Newport, however, arise new needs. To supply these needs is to work for our own benefit, for the more attractive we make the place, the greater the convenience of our stay and the greater our pleasure. One of these needs seems to be a public aquarium.

From the beginning of the world the human mind has ever been striving to discover the unknown, and in the beginning everything was unknown. Little by little nearly every part of physical science has been elevated from the realm of mythology, its strange but natural birthplace, to its present honorable development, by the means of the scientists. The steps by which the higher planes have been attained are easily recognizable. In some branches of knowledge the success has been greater than in others; and modern science points out to us the best aids for investigation.

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*Read before the Society August 7th, 1884.

In the study of marine life the most effective aid is the aquarium. Perhaps he is wisest who best studies what is nearest to hand; and he is a poor observer who finds nothing at home. Here, at Newport, the richest forms of marine life lie at our feet, and are brought to us daily in vegetable and in animal shapes of surprising beauty. These forms thrown upon our beaches, and, it may be, covered with slime, may be only repulsive to us, but if we see them in their natural states, in all the glory of hues surpassing the colors of land forms, they cannot but please. Even when repulsive, many a person has a curiosity to know their purposes and their uses; but when they may easily be seen in their full beauty, all persons learn to look at them with pleasure. The most effective way of bringing them to the observation of mature minds and to make the young, happy observers, is an aquarium, which enables us to know the wonders of the deep without being a naiad. There is such a wealth of marine life at our feet that some educational use ought to be made of it. The children of our City need that form of pleasant instruction which an aquarium affords. Without it, a large amount of useful information is lost, not only to youth but to manhood. The sea life in an aquarium is a sort of living picture book, but it is a picture book as fascinating for the mature, as it is enchanting for the young. It is the duty of some one to open, and to keep open, this delightful book for public pleasure and profit. Some knowledge of aquatic life is not superfluous, and modern advancement declares that it should not be confined to the professional student. Our ancestors of one hundred years ago may have thought that to follow a fox was evidence of better spirit than to study entomology, but were they now alive they would readily admit their mistake; like the young 'squire who, though astonished that anybody should have written such a book as the "History of Selbourne," was forced to exclaim after reading it, "Bless me! who would have thought that there were so many wonderful things to be seen in one's own park!" or like the old 'squire, who put the book down with the exclamation, "Why, I have seen that and that a hundred times, and never thought till now how wonderful they were!"

Like geology, natural history has made great strides within the past fifty years, and it has become so interesting, that it is an injury to remain in ignorance of its wonders. Summer rest ought not to mean complete idleness, for the best rest is usually a change of occupation. Hence it is that society wisely provides places of amusement. Now what pleasant places of profitable resort have we in Newport? There are libraries, but even they may not be at all times the proper recreation for those needing distraction which would be profitable without labored effort, for others in search of beneficial novelty, and for children grown tired of books and winter study. Perhaps an aquarium is not the only thing needed in Newport, but it is the only need which we are now considering. Let any one read Kingsley's "Glaucus, or the Wonders of the Shore," and he will regret that there are now no means of gathering in one place the interesting forms of life of which he lazily reads. Read to a child Mangin's "Mysteries of the Ocean" or Hartwig's "The Sea and its living Wonders," and you will be sorry that you cannot show him more than a cheap woodcut, which, however good, is, relatively to living forms, always unsatisfactory. But what neither young nor mature minds are willing to read about, however pleasantly written, is looked at without effort and with glowing pleasure. A public aquarium is the only means of showing what all may pleasantly and profitably know of marine life; and it will undoubtedly contain what will most astonish those who have been longest in unconscious ignorance. It would require no preparatory education, for all who have eyes might have pleasure. It seems strange that all the wondrous and beautiful sea life should be neglected. Neglected it must be without an aquarium, for how many are there who ever examine any of the strange forms found upon the beaches? or who, at low tide, overturn stones in search of strange animals? or who take advantage of the neap tides to collect specimens not at other times easily found? Sea-weeds cover much, our horses' hoofs and our carriage wheels crush more, and our bright inquisitive children are taught to shun what would honorably inflame their eagerness for knowledge.

The word aquarium has been a matter of contention, and to philologists it is still objectionable. A few years ago there was an earnest and angry discussion as to the correct name for keeping alive in tanks the various forms of fresh and salt water life. A few wished it called vivarium, but the objection was quickly made that a zoological garden was a vivarium, as was also a dog kennel and a stable. Another word special to the preservation of marine life was necessary, and to meet the need the word aquavivarium was proposed. It was correct, but, alas, it was too long for daily use, and so by common consent the incorrect term aquarium was adopted. The linguists who said aquarius meant a water-man could not resist the tide, and so aquarium, however philologically objectionable, is a fixed word.

Although the aquarium is the result of recent knowledge, the preservation of live fish has been in use for centuries. The fish ponds were the most natural and the earliest of all the means of keeping fish in readiness for any use. The ancient Romans vied with one another in the attention paid to their preserves, and they spared no expense in stocking their ponds with the most beautiful forms. The stories told of these ponds seem almost mythical. It was not uncommon to have them connected with the banqueting hall. The favorite fish seems to have been the Red Mullet. Clothed in brilliant colors of bright red, mingled with silvery tints upon its sides, the Red Mullet owes much of its celebrity to its attractive colors. Not only for its beauty of form and color, but for its delicacy, did the Romans cultivate this fish in their ponds. The rich patricians of Rome enjoyed seeing the Mullet expire under their eyes, while at table, for thus only were they able to see the various shades of purple, violet and blue, which succeeded each other, passing from cinnabar-red to the palest white, as the animal losing its strength, slowly expired. The Mullet was of great value and an evidence of wealth. One weighing 4½ pounds is said to have cost $300; but in the reign of Caligula the price became so high that $1200 was paid for a fine specimen. Although the Red Mullet is no longer the object of cruel enjoyment, or of prodigal expenditure, it is still much sought after, both for its beauty of color and its tender flesh. It is found in many seas, but particularly in the Mediterranean.

In Pliny, we read that the fish pond of a Roman patrician was sold for more than $160,000, and that the fish from the pond of Lucullus brought an equal amount. The Romans gave also great care to the preservation of oysters and sought them far and near, bringing them even from Britain. The oyster eaters were not at all ashamed, but rather proud of their capacity. Vitellius ate oysters at all hours of the day, and is said to have eaten 1,000 at a sitting. The temperate Seneca, too, who wrote so very beautifully of poverty and yet complains that he could not live comfortably upon his beggarly $10,000,000, used to eat a few hundred oysters a day.

If it did not take us out of our way, it would be easy to multiply modern instances of extraordinary capacity for oysters, as for example, the story told by Brillat Savarin of his guest, who, without effort, at one sitting ate 32 dozen oysters. By the Chinese, fish have for a long time been kept alive for table use, and they have long kept them in artificial tanks for amusement. In the middle ages, the monasteries, the abbeys, and even the baronial halls had their fish ponds, though more as a matter of necessity than for pleasure. The castle moats were often made to serve the purpose of fish preserves. The fashionable tastes of those days may seem strange to us. The upper classes thought Pike and Tench as fit only for the lower orders; but, nevertheless, they thought toothsome bits the coarse flesh of the Sea-dog, the Porpoise, and even the Whale. A century later the Whale was salted for the use of the common people. The food fishes of the masses were the Conger, Cuttle-fish and Sturgeon; while the Turbot and the Sole, being very high priced, were reserved for the wealthy.

The aquarium did not come into use, until the discovery that animal life might be maintained by a proper adjustment of vegetable life in the same tank, so that the one might supply the needs of the other. The earliest aquarium on this modern basis is that of M. de Moulins, begun in Bordeaux in 1830. About 1850, owing to the researches of Mr. R. Warington and of Mr. Gosse, began the rage for small or household marine aquaria. Every lady of fashion had in her drawing rooms an aquarium resplendent with brass and plate glass, and every school boy had his aquarium, humbler in appearance, but equally instructive. Although the household aquarium may easily be maintained for beauty or for instruction, the rage, like the recent craze for old china and for bric-a-brac, did not last long, and was cast aside in favor of some new fashion. The first public aquarium in England was opened in 1853 by the London Zoological Gardens; and though not as large as others since founded, it has been of efficient service to the cause of science as well as to education. Other aquaria were soon established in the Surrey Zoological Gardens and in Dublin. As soon as it was found that, by aërating the water or by properly adjusting aquatic plants, no great labor was needed to keep marine and fresh water animals alive and healthy, public aquaria were begun in many towns of Europe—Belfast, Galway, Edinburgh, Scarborough, Yarmouth, Boston, Vienna, Hamburg, Cologne, and especially at Havre. The first of the large public aquaria, now grown to such a great size, was that opened by the Paris Jardin d'Acclimatation in 1861. The Crystal Palace aquarium was begun in 1871. The great aquarium of Brighton was of even later origin. Its enormous tanks hold over 300,000 gallons, the largest one alone holding 110,000 gallons. The founding of the aquarium at Naples by Dr. Dohrn, a German naturalist, was an important event, as it was designed for purely scientific observation.

A station for the study of marine life is now maintained by Professor Agassiz at Castle Hill; but being for purely scientific purposes it cannot answer the need of a public aquarium. Another station of the same kind has been established and maintained on the southern coast by the Johns Hopkins University. In England at present there are three very large inland aquaria, at Manchester, at Westminster, and at the Crystal Palace, and large seaport aquaria are in process of erection at more than a dozen places.

It has been found that large aquaria may be rendered places of the highest amusement, as well as of the easiest and pleasantest instruction. All large towns ought to be provided with them. For the settlement of many most important questions in the matter of food-fishes, the world is largely indebted to them. In one instance, at least, an observation made at the Brighton aquarium was the means of preventing absurd legislation, which would have had an effect just opposite to that intended. In 1865, it was proposed by a Royal Commission to prohibit trawling during spawning seasons, on the ground that the eggs of the cod and the whiting, the most abundant of the food fishes, were deposited on the sea floor. But lo! it was timely discovered that the eggs of both of these fishes, as well as those of the mackerel floated on the surface during the entire period of development. But for this discovery the law would have been passed, and the fishing trade would have suffered and the fish supply would have been greatly and needlessly diminished. The United States Fish Commission, under the charge of Professor Baird, has rendered great service to the world by its study of the food fishes. The fisheries form such a large and important industry of the world, that any information as to the habits of food fishes is of much greater importance to trade and to the toiling fisherman than at first sight may appear, and the steamer Albatross, with its constantly renewed aquarium, has aided the fisherman, has benefited trade, has stocked lakes, streams and rivers with edible and with game fishes, and thereby has reduced the cost of the most toothsome of the finny tribes. The habits of animals can never be thoroughly known until they are studied in detail; and the more we know of fishes, the greater the variety of our food supply and the less the cost to the consumer.

A public aquarium insensibly exerts a higher influence than that of gratifying gaping curiosity. It gives information in a most easy and pleasant way, and at the same time it incites even sluggish minds to beneficial activity. For mature minds it would be not only an easy pleasure, but an incentive to some form of study. Book knowledge usually grows tiresome; but the knowledge gained from observation, coming so easily, seems to require no effort, never becomes stale or monotonous, and opens up to us new and pleasant paths of previously undiscovered ability. In the pursuit of knowledge the observer has a great advantage over the mere book student. The powers of observation are best expanded in childhood. The child's observation, so often troublesome with its many queries, is as often termed curiosity. Such it occasionally is, but it is a pity that the child does not have the satisfying information, at the moment its mere curiosity may call for it. Even to children an aquarium is a full satisfaction, and the best form of pleasant education in the matters of natural history. This kind of study makes them become observers in the true sense of the word. There could hardly be provided a better supplement to the education of children, a better adjunct to the reading of mature minds, and a surer correction of the listless idleness of youth. For all of its classes and for every age Newport needs a public aquarium. For Newport it would be the best form of popular education ; and as such, it would be within the reach of everyone, and, consequently, would be of the greatest benefit.

Another and not less benefit of a public aquarium is the fact that it removes that ignorance which is superstition. The mythologies of Egypt, Greece and Rome, the Scandinavian folk-lore and the myths of the middle ages are full of examples of ignorance or superstition that were hurtful. Strange, indeed, were the things which used to be told and believed of the animals of the sea. There was the Chilon with a man's head. There were the wonderful Dolphins, digging graves for their dead parents and friends, always giving them a solemn funeral procession, and burying them in graveyards cunningly hidden from rapacious fish. Then there was that strange fish the Dies with two wings, two legs, but living only for a day. In classic times there was a Proteus, a Nereus and a Glaucus, who tended the marine flocks of Neptune. Poseidon was nearly always accompanied by queer creatures, half men, with cloven feet and long tails, who could calm the stormiest sea by a blast of their shell trumpets ; and the story was not thought at all improbable. Every country has had its legends of horrible sea beings, who entered into ill-fated relations with human beings only to contrive their ruin. Hence comes the White Lady of Scotland, the Vix, or Undine, of Germany, the Merminne of the Netherlands and the Neck of the frozen North. From this belief in strange sea monsters, the ancients drew their sirens, Blanche, Harmony and Virgin Eye, who lured so many to destruction, until they were defeated by Ulysses. Pliny was not quite sure that these tempting singing monsters did not exist. The story, changing with the country, as in the "Old man of the sea," of whom we read in the "Arabian nights," has come down to our day. Perhaps such strange beings were the ancestors of the mermen and mermaids, those lonesome dwellers of watery wastes. Even Christian authors have delighted to revive pagan beliefs ; but have made the mermen cease to be mere monstrosities and have clothed them as human beings, and have gone so far as to give them some human feelings. Such stories were multiplied so rapidly that sailors carefully learned each new rule for avoiding the dangerous sirens. Those who went to sea were told to throw to the beguiling monsters bottles, with which they would play sufficiently long to permit of the sailors' escape. They were told, however, that if the bottles did not succeed, they must stop their ears with wax and pray to heaven for assistance. Cabot, the discoverer, advised his officers that prayers against the enchantments of sea monsters be held twice every day, and that all inventions of the Evil One, like dice, cards and backgammon should be prohibited; but especially they were "to take good care against certain creatures which, with the heads of men and the tails of fishes, swim about in the fiords and bays, armed with bows and arrows and feed upon human flesh." The excited imaginations of the sailors made them see sirens, or other wonders of the sea. Even Columbus, sailing along the coast of St. Domingo, met with three sirens dancing on the waters. These sirens, however, were so destitute of either beauty or song, that Columbus wittily said that they must be grief stricken because of their enforced absence from Greece. John Smith, the navigator, when nearing our continent, saw a beautiful woman gracefully swimming near his vessel. Her charms were so great and so many, that she might have captured the navigator's heart had she not ignorantly exposed her forked fish tail. Mermen and mermaids make a prominent part in the sea stories of Denmark, and each town has its own legends; but the mermen are less interesting than the maids. Both appear to the sailor and give him warning, or they come on shore, help the wearied in many ways, and disappear only when they are ill treated or ridiculed. As soon as modern investigation demanded proofs of the existence of such beings, smart cheats began to manufacture them, as by skillfully joining the body of an ape to the lower part of a fish, and such sirens are to be seen in some of the museums. In England, a living mermaid was exhibited, who held the historic mirror and comb in her hands, and playfully splashed the water with her tail, but when rural curiosity was at its highest, it was discovered that the mermaid was a poor woman ingeniously covered by a fish skin. We will not attempt to recount the blood-curdling stories of the sea serpent of our day, nor to explain that long and irregularly shaped masses of seaweed floating in phosphorescent seas may readily be mistaken for the many armed serpent. Sailors delight to tell of their escapes from sea serpents, and just as much dislike to have their stories dissected by the scientist's knife.

The fitness of Newport for an aquarium cannot be doubted, for everything here suggests one. If even inland towns may have aquaria, Newport on the sea, with its better facilities, ought not to be without one. There is here a choice of excellent sites. As the aquarium would be public, for the benefit of all, the City authorities might be induced to assist the project. If the City has no land to give, the cost of a suitable property would not be very great, inasmuch as the best building site is not necessary. Perhaps the site, free or at a low ground rental, is the last thing to be considered, and it may also be the least of the difficulties. A public aquarium is not a matter of prayer, it ought not to be of charity, and it need not be more than a slight tax. Like any other project, it has its difficulties. If, as it seems, these difficulties can be easily overcome, the work should be undertaken. If undertaken, it needs to be under the control of some organization of honorable aims.

Perhaps the principal expense would be in the construction of a suitable building; and herein lies the occasion of foolish extravagance with ruin, or of wise economy with success. It is wiser to better the instruction, than to make the buildings pretentious with porticoes, colonnades, spires, turrets or pavilions. If the building be even temporary in construction, it would be sufficient until the project was shown to be not only a necessity, but self sustaining. The simpler the building, the better for the beginning, provided that it be well stocked. The marine life needed for it would be but little expense, and it is probable that nearly all of it would be furnished for it, without cost, by the United States Fish Commission. The Fish Commission has lately done much good in extending useful knowledge of marine life, by sending cabinets of carefully chosen specimens to even the smaller schools of our country.

It may be taken for granted then, that a public aquarium at Newport, with its proposed educational character, would be well provided and at a merely nominal cost. The fishes of our coast are many; and it would take much tank room in an aquarium to show them all. It would not be difficult, however, to exhibit the better kinds of fish of our coast; and those with which we are perfectly familiar are:—The Black Fish, the Chogset, various kinds of Bass, the Blue-Fish, the Dog-Fish, the Eel, the Flat-Fish, the Flounder, the Halibut, the Herring, several species of the Mackerel, the Menhaden, the Minnow, the Scup, the Salmon, Shad, Sheep's head, Skip-jack, the Smelt, Tautog, and the Weak-Fish. Then the following native fish with which we are not quite so familiar:—The Bellows Fish, the Bill-Fish, the Black Pilot, the Red-tailed Bream, the Bull-head, the Carp, the Silvery Dace, the File-Fish of Mass, the Globe Fish, the Grunter, the King-Fish, the Plaice, the Rudder-Fish, the Sea-horse, the Shark of many kinds, Skate, Sturgeon, Sun-Fish. The Porpoise is very common; small Whales are found outside; Sword-Fish are plentiful; and in the winter, Seals inhabit our bay.

It is not my present purpose to consider in detail how the aquarium is to be maintained. Whether or not it must be from the start self-supporting, is a matter which further consideration can more fittingly decide. Once started, it would seem that to maintain it by subscriptions need not be more than a slight tax.

The details of the establishment of an aquarium are many and they ought not to be decided hastily, but however many, they are not beyond decision or formidable. As a business speculation, the aquaria of England and of the continent of Europe have proved successful, as is shown by the increase in their number. It may be held that the population of Newport is too small to meet the running expenses of an aquarium; but the aquarium would not be dependent upon the resident population. It would have for support, principally the summer residents, and the day excursionists, the numbers of which it would greatly increase. It must be remembered that in all New England there is not a public aquarium. It would, consequently, be without a rival; and as such, it would prove to be an attraction to the people in the outlying towns. It may be doubted that the project would pay dividends at present, but it cannot be doubted that the honor, the pleasure and the educational profit, would be great and lasting.

If the project be undertaken, it cannot be well begun without organization, and the only and proper organization to undertake the work, is the Newport Natural History Society. Seemingly, it would best meet the proper object of such a society; and it would certainly give the Society a claim, not only upon the gratitude, but upon the support of the public. It would give the association something to do and something to care for; and societies, like individuals, are always better and do better, when with constant employment. Lack of a definite object ruins both the society and the individual, and more harm is done by being without a practical object than by the undertaking of too many objects. Nothing worth the having comes of itself. Everything good requires an effort, whether the good proposed be of a society or of an individual. From the Newport Natural History Society we have a right to expect some public benefit. When it shall have secured us a public aquarium, our expectations will happily be realized, and we will look to its accomplishment, not merely as a substantial future benefit, but as a mark of present progress. With this dawn of improvement, with this outward show of beneficial material prosperity, there will come up the desire for that which is superior to external objects, new wants of a higher nature and a greater desire for cultured association. In seeking to establish intimate relations between ourselves and the great world of science around us, we are partaking of that progressive spirit of the age which animates our own people in common with the people of the most civilized portions of the earth, which is everywhere demanding as its best end, improved means of popular education, and which is finding it in many ways, but in no way more perfectly than in organizations studiously working for public enlightenment.

THE WORSHIP OF ANIMALS.

By REV. C. W. WENDTE.*

Zoolatry, or the worship of animals, is one of the most widespread and deeply-rooted of the early adorations of mankind, and found not only among primitive and savage peoples but surviving in higher levels of culture.

It would seem as if the religious sentiment had manifested itself in no more singular and repulsive form than in this worship of the brute. Strange and revolting spectacle to see man kneeling before the beast, the superior worshipping the inferior intelligence! The origin and meaning of Zoolatry is a subject fraught with difficulty. Of late years new light has been thrown upon it by the careful researches of the ethnologists and missionaries into the animal worship still maintained by existing savages. The lecturer proceeded with much elaboration and many illustrations drawn from the religious life of ancient and modern peoples, to state the causes which, in the opinion of leading authorities on the subject, account for the existence of Zoolatry. First, the animals were worshipped directly for certain real or imaginary qualities attributed to them. Secondly, they were revered as the incarnations of deceased ancestors or the chosen seat of higher deities. Next veneration for a tribal totem or clan animal led to its adoration. And, lastly, the early identification of the brutes with the celestial phenomena connected them mystically with the worship paid to the sun, moon and stars.

To account for the continued existence of Zoolatry among more advanced races and on higher levels of culture we must consider it as a simple case of survival and inheritance from the past. When the higher religion came it found the old one already in possession of the ground and unable to crush it out entirely was compelled to incorporate it with such changes and modifications as were possible. Thus ancient Egypt when we meet it in history was a land of spiritual conceptions in religion and also of sacred cats and dogs, jackals and hawks, bulls and serpents. But the latter were no longer worshipped, except by the most ignorant of the population, for any divinity in themselves, but only as representatives of higher deities or as the favorite symbols of the gods. In India, also, we find the spiritual deities of the Brahmins worshipped under the forms of animals or with animal accompaniments. These serve to show that the new Brahminic religion was compelled to accommodate itself to some extent to the older and grosser faith it superseded. Many illustrations of this accommodation in Hindu religion were given by the lecturer.

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*Abstract of a paper read before the Society November 6th, 1884.

A final cause instanced to account for the persistence of animal worship among more civilized people was the wide-spread belief in metempsychosis or transmigration of souls. When the man sees in the dumb brute an imprisoned ancestral soul he cannot but venerate and adore his returned but mute protector and friend.

In conclusion the lecturer treated in detail of some of the more noteworthy creatures to which divine honors have been paid by man.

REMARKS UPON THE COMPOSITE PHOTOGRAPH.

By PROF. RAPHAEL PUMPELLY.*

REMARKS UPON THE SCIENCE OF BOTANY.

By RICHARD LEWIS.†

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"OUR FRIENDS THE SPIDERS."

By REV. FORREST F. EMERSON.*

Oliver Wendell Holmes, in his recent life of Ralph Waldo Emerson describes the attempt of a professor of metaphysics to criticize one of Emerson's essays. The failure of the logical scholar to penetrate the obscurity of Emerson's style is likened to the fruitless efforts of a dog in trying to make the acquaintance of a tortoise.

I thought of Dr. Holmes' comparison as applying to a clergyman who undertakes to dabble in science. If my friend, Dr. Francis, can imagine what his feelings would be were he called upon to preach a sermon to-morrow on the "Subjective Nature of Human Depravity" he can imagine mine when invited by him to address a Natural History Society. The blame for this singular proceeding must be laid at his door.

As to the choice of a theme, if it is said that the spider is a repulsive creature it may be said that many of the animals most disgusting in appearance are endowed with skill and intelligence as wonderful as others, and with organs and apparatus which are marvels of mechanism and of adaptation of means to ends.

If it be said that the spider is ferocious and unchristian in disposition, on the score that he "lives on fly" which he has first cruelly captured and killed, it may be replied that it is not more unchristian than Christians who "live on lamb" which they have first taken and killed. In fact the spider, repulsive as he is in appearance and savage as he is in disposition, is endowed with most remarkable intelligence and skill, and furnished with wonderful organs for the performance of wonderful work. The spider then is my theme.

Making no pretensions to scientific knowledge and with no attempt at classification, I shall endeavor to present a few of the general characteristics of the spider, with special reference to the chief peculiarity wherein it may be regarded as a living machine, both for the spinning of silk, and for the weaving of the same into the most wonderful fabrics; sometimes as cocoons for its eggs and young, sometimes as a lining for its nests, sometimes as a network for the capture of prey.

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The spider is classed with the articulates, between insects proper and the crustaceans. The body is divided by a single articulation into chest and abdomen, the head being continuous with the chest. There are four pairs of legs, and if one is lost by accident it is reproduced at the time of moulting. There are spines and hairs covering the legs, and the feet have a most delicate sense of touch in handling the web. There are usually eight eyes, sometimes six, differently arranged in different species. Some of the web builders seem not to see, simply distinguishing between darkness and light, while the hunting and field spiders have a very sharp sight, and will look a man straight in the eye. From the root of the jaws extend the falces, or sickle-shaped forceps, powerfully made for holding prey, and with the joints or hooks turned inward. At the base of these in some species is a poison sac, and a slit in the outer covering near the end of the fang lets out a drop of liquid poison. There is a great difference in different species in respect to venom. The field and hunting spiders, which depend on their jaws for taking and holding their prey, are usually poisonous while the web builders are not. But the poison even of the large field spiders in our latitude ordinarily has little effect upon human flesh, though deadly to insects. The spider has colorless blood, a heart, arteries, and vessels returning blood from the respiratory organs, these latter consisting of pulmonary sacs and lines of trachea extending to all parts of the body and limbs. Digestion goes on as in larger animals. The spider is always carnivorous, devouring living prey, sucking the juices, and generally rejecting the fragments.

The family life of the spider is peculiar. There can be no discussion about woman's rights—might makes right—for the female is much the larger, handsomer, and more active. In almost all treatises on the spider, every interesting description is about *her*, and not about *him*. She spins the web, provides the food, and is general manager and man of the house. The male has very little to say for himself, is kept on short allowance, and may regard himself fortunate if his wife does not eat him up, which she sometimes does. In general however she barely tolerates him. Some idea of the disparity in size may be had when we learn, that if an ordinary man of 150 pounds weight had a wife as much larger than himself, as the female of the *Nephila Plumipes*, or Charleston spider is larger than the male, she would weigh 18,000 pounds. The disparity is not so great as this among all species of spiders, but it is a peculiarity among them all. The spider can support long fasts and remain torpid during the winter. Some of them are very courageous and powerful. In the West Indies and South America they have been found with bodies three inches long and spanning eight and ten inches with their feet as they stand. These spiders when poisonous will kill a large insect by a single grapple of the fangs; while the large web builders have been known to entangle and kill humming birds and even finches. Even in our own fields, spiders are met with which are very plucky. They will often face a man, lift the head and jaws, and make a decided show of fight. I have seen in Massachusetts a grey spider make a stand-up fight when surprised in the grass by a mower, and when the scythe was held towards him would strike it with his fangs so hard as to make a perceptible ringing sound from the metal.

The remarkable fact about spiders is the arrangement for the spinning of silk, out of which they manufacture cocoons for their eggs, nests for themselves, and webs for the capture of prey. The substance out of which the web is made is a viscid, transparent fluid contained in sacs within the abdomen. From these sacs the liquid is conducted to the spinnerets by hundreds of minute ducts. There are generally three pairs of spinners. The spinners as seen under the microscope are obtusely conical projections, covered with hundreds of minute orifices by which the ducts open out to the air. There is some muscular control of these spinners, so that they may be slightly turned towards, or away from, each other. In the Charleston spider, so called because first discovered on an island in Charleston harbor during the civil war, one pair of spinners produced a beautiful gold colored silk, one pair white, or silver colored and one pale blue; and as the concentric circles of the web of this spider are made with the gold colored silk, the radii and guys and stays with the silver colored silk, while the pale blue was found wrapped about the prey after the spider seized it, it was thought by one observer there that spiders may use one or all of the spinners at will. The substance of the silken web, although a viscid fluid within the spider, instantly becomes dry on reaching the air. The filaments expressed from the numberless ducts which lead from within out upon the surface of a single spinneret unite in a single thread and become the line from that spinner; at a little distance this line unites with that of the twin spinner, and these two unite with those of the four remaining spinners, and it takes all together to make that fine, almost impalpable thread of silk with which the spider weaves his web, or by which he hangs suspended from the ceiling.

It will be seen that the spider carries in his pocket a power-loom that needs not water nor steam to run it; the means for the instantaneous creation of a suspension bridge; and the most perfect fire escape ever invented.

Having spoken of the process of spinning the silk, let us examine the labor of manufacturing this silk into various products.

And first, the spider weaves with this silk beautiful, soft cocoons for its eggs and young. These are in various shapes, sometimes long pendent shaped bags, sometimes in the shape of an inverted wine-glass, sometimes round. They are woven very closely of compact silk and some of them are quite elegant productions. Some species of spider, however, do not take this trouble, but make use of leaves, or the two halves of a seed-pod which they fasten together by taking two or three turns of silk about them.

The next class of manufactures from the silk, to which we shall refer, is the building of nests. Not all spiders are web builders, many taking their prey by direct attack, without the use of a web. These are called hunting and field spiders. Some of these hunt in the night retreating to their nests during the day; some hunt in the grass by daylight; some in the woods; some on the top of the water of ponds and rivers, as we shall see presently. All these make no use of the web, but they spin silk, many of them to line their nests. To these they retire to devour their prey.

The nests of spiders are among the most remarkable curiosities of natural history. The trap-door spider of Jamaica burrows in the earth and lines its burrow with a thick, heavy lining of compact silk, somewhat rough in appearance like the material of a wasp's nest. Inside of this is another lining of silken softness, the interior surface of which has a smoothness and consistency resembling paper on which books are printed. The entrance of this tube is guarded by a cover or trap door. The door is woven on to the lining of the burrow, of the same material, with a somewhat broad hinge, and fits the orifice with perfect accuracy. The outer surface of the lid is sprinkled with a thin layer of earth, of the same color as that surrounding it, and as it adheres to the glutinous silk, and as the trap door is flush with the surface of the ground, there is no trace of the burrow to be seen when the door is closed. The burrow is made on sloping ground, with the hinge uppermost, so that when the spider leaves her home, or retreats to the bottom of her burrow, the door closes of its own accord. Should a person approach when the lady of the house is lifting the cover and peeping out, she pops back, like the cuckoo in the clock, pulling the door after her with a smart clap. If a person should lift the lid gently while the spider is within, she hooks her hinder legs to the lid, her fore legs to the side of the burrow, and pulling and resisting with all her might, practically says "you can't come in."

One of these silken nests now in the British Museum, made by an Australian spider, has its hinge across the middle of the top, like the cover of a syrup pitcher, instead of at the side, and this cover is bevelled off inward on the under side so that the closure of the entrance is absolutely accurate. These spiders hunt in the night, and devour their prey at the bottom of their burrow.

Among the spiders who do not weave a web for prey are the water spiders. One of these breathes atmospheric air and yet builds its home under water. It spins under water a silken oval-shaped nest, not unlike an inverted acorn in form, open at the bottom, and attached to the branch or leaf of a water plant. When all is finished it takes its position in this nest head downward waiting for its prey, but it must have atmospheric air to breathe during the hours of waiting, and while eating its hardly-earned dinner. The problem is, how to fill this silken bell with air. This is the way it accomplishes the task: It introduces air, one bubble at a time, until the water is expelled, and its home is then almost exactly on the principle of the modern diving bell. The introduction of air is a curious and marvellous feat. The spider rises to the surface, and turning its body with a sudden spring entangles a bubble of air by a peculiar way of turning its body and crossing its legs. Then descending and keeping the bubble of air under itself, as a man might do under the hollow of his inverted hand if he were quick enough, she carries it quickly down and passing under the bell, the air is released, and rising to the top expels from the bell so much water. She does this many times in quick succession until there is space enough in the nest for her purpose; she then takes her position head downward and waits for her prey.

Another species of aquatic spider is called the Raft spider. It runs easily on the top of the water, but that it may have a resting place for devouring its prey, it gathers a number of leaves, winds about them a few turns of silk to hold them together, and mounting on this frail bark sets sail in search of booty. The breeze and the little waves of a pond are the propelling force. The aquatic insects that come to the surface, gnats which obtain their wings on the surface of the water and are still too weak for flight; insects which are themselves skating about on the water in search of their own prey, and land insects which fall into the water by accident become the victims of our brave privateersman. Occasionally he darts from his raft for some tempting insect, and having seized it returns on the surface of the water to his ship to devour it. This spider is of a very brilliant appearance, its general color being a rich, chocolate brown, the outline of the upper part of the abdomen and thorax is marked out by a broad band of orange, with white spots underneath, while the legs are a pale red. Altogether a dandified and gayly decorated pirate, gotten up regardless of expense.

We come now to the true web-builders, the spinners and weavers of nets. I shall endeavor to describe three classes of webs:

First. There is the regular geometric web of the common garden spider, though it is doubtful whether there is ever found a true geometric web. In a geometric web, truly such, the concentric circles would meet. But this is not the fact in the common spider's web. Instead of meeting, the circles pass by each other as they come round to the point of starting, and thus form, not a geometric circle but a spiral. In the construction of this so-called geometric web, the guys and stays are first attached to surrounding objects; then the radii are made, running from a common centre to the circumference. The guys, stays and radii are made of a firm, dry, inelastic silk. When this preliminary frame-work is done, the spider weaves on the concentric circles, attaching each circle to each one of the radii by the direct application of the spinners so as to make them adhere. These circles, not only with this spider but with all spiders, is made of an elastic silk, covered with a viscid gum which, after the line passes into the air, gathers on the thread in globules so numerous and so minute that it is estimated that on a web sixteen inches in diameter there are 100,000 of them.

Second. The eccentric web. The Charleston spider is known in the scientific books as *Nephila plumipes*, meaning the feather-footed golden fleece, so-called from the fact that there are bunches of feathery growth on the joints of its legs, while one pair of spinners produces a silk of very fine quality and of the color of gold. It was discovered during the war on the islands in Charleston harbor by an officer of our army who is a naturalist. It builds an eccentric web. The focus of this web is near the top, where the spider takes position head downwards, waiting for prey. The radii, guys, and stays of this web are made of inelastic threads of silvery color, while the circular lines are of elastic, viscid silk of golden color. Though usually making one thread of all the spinners, it is believed that spiders may use one or all of the spinners at will. But why the golden spinners should produce silk ordinarily dry when reeled from the body, and viscid when used for the concentric circles of the web is not as yet understood. It may be that the same spinner sends out the line and at the same time covers it with the viscid gum, or that one spinner produces the filament while another covers it with the gum. At all events with three pairs of spinners the Charleston spider spins four kinds of silk; the golden dry, the golden viscid and elastic, the silver dry, and the pale blue.

As I have before intimated the circles of the web are not concentric, or spiral, as in the regular web of the common spider. They do not pass completely round a common centre, but are cast over the upper radii in loops and brought back upon themselves in an opposite direction, never passing a point above the focus. In this web some of the circles (and this is a peculiarity of this spider) as well as the radii, guys, and stays, are made of the dry silk.

Third. The triangular web. Professor Wilder, of Cornell University, found a spider a few years ago near Ithaca, N. Y., which does not seem to have fallen under the notice of observers elsewhere. He calls it the "triangular" spider from the fact that it builds a web, not geometric or eccentric, but triangular in shape, and this triangular shape is proof of a purpose which shows almost human intelligence. A base line as a stay or support of the web is attached vertically to the trunk of a tree adhering only at the two ends. From this four lines, always this number and no more, start at equal distances from each other and converge to an apex, or acute angle, and then extend as a single line to some fixed point. These four lines correspond to the radii in the ordinary web, and the transverse elastic lines correspond to the concentric circles of the same. The web when finished is considerably longer than the distance between the two points of attachment and this slack line is for a purpose which is the most striking evidence of the intelligence of this spider. The spider takes up the slack herself; and wonderful as is the piece of work which she has accomplished, her management of this web in taking her prey is still more wonderful. Although in spinning the ten transverse lines she is believed to make 9,000 movements with her hinder feet, yet, without a moment's rest, she takes her place when the web is finished, on the single line between the apex and the point of attachment behind her. Hauling the single line taut behind her with her hinder feet, she draws in the web and makes it taut with her first and second pairs of feet, precisely as a man would haul a sagging hammock by pulling at the single line at the end. The third pair of feet when desired may lightly hold the slack rope.

She is now ready for business. For hours, if necessary, she holds her place pulling taut the line and keeping the web firm in position. When the unlucky insect comes in contact with her web, she suddenly lets go with her fore feet all the slack line, and the web being lower and heavier, the apex line is drawn taut, the net falls outward and downward upon itself in a kind of collapse, the transverse elastic and gummy lines are brought nearer together, and thus the entanglement of the prey is insured. The spider then creeps cautiously out on one of the radii, and if she is not sure of her game runs back draws everything taut as before, and if the insect is still in the toils again lets go with a snap; she has been known to repeat this six times in succession before venturing a personal encounter with her victim.

But furthermore, and still more wonderful, she has another method of using her web. Contrary to the popular belief that animals have but one way of doing things, they often have several, conforming their action to circumstances. For sometimes, this spider, instead of simply letting go the slack line, takes more desperate measures. Fastening a new line to the tree behind her for her support, and reeling from her body as she advances keeping thus a line of possible retreat in the rear, she cuts the apex line with her jaws, still holding to the line in front of the cut she has made, and supported in the rear by the new line attached behind; she then again advances and grasps all the radii where they meet and cuts them with her jaws; advances again, rapidly, and bites off more still, holding by what remains with her fore feet; at each successive cut, as she advances, the web slackens, recoils and falls into collapse, just as it did in the former case when she simply let go the slack line, until, finally, spreading her feet far apart she gathers up the radii once more and with a quick movement throws the whole of the web like a blanket over her prey. Then grasping the whole mass she transfers it to the third pair of feet which roll it over and over, while she holds on to the ruin of the web alone with her fore feet, and with the hinder feet she draws out from her spinners broad bands of new silk, winding it around and around the struggling insect, now hardly visible. Having reduced insect, web, and all, to a rounded mass, she seizes the whole mass, the insect in his silken shroud, more dead than alive, and mounts with it to the recent scene of her waiting patience and there devours her prey. This spider thus completely sacrifices its web, the product of so much toil and skill, and the capture of a single insect involves the ruin of the cunning machine elaborately built to accomplish it.

As to webs in general, it may be said that as the radii are generally covered with the viscid gum, the web is very elastic, yielding to the struggles of insects without breaking, and withstanding the force of the wind. If the wind is strong, however, the spider shows her intelligence by loading the web with sticks and small pebbles to hold it firmly in place. The accuracy of web building is determined by feeling, the eyes being away from the work ; the sense of touch in the feet being so acute, that in experiments made for the purpose, the web has been woven accurately in total darkness.

Another point of interest is, that silk may be reeled directly from the body of the spider. As the spider drops from the limb of a tree, having first fastened the filament of the silk to the limb, and reels out as she descends ; so, on the other hand, an expert in handling spiders may force the spider to remain stationary, while the silk is drawn from her body. The observer before-referred to captured many of the so-called Charleston spiders and performed many experiments, among which, was the reeling of silk directly from the spider's body. From these experiments we have some knowledge of the enormous silk producing capacity of the spider, the exceeding fineness and beauty of the material, and the weight and strength of it. Finding a beautiful specimen one day on Folly Island, he placed it on the side of his tent, and lying down on his camp-bed, attached the thread to a quill, and wound it round and round. In one minute, six feet of silk were wound upon it, and at the end of an hour and a half he estimated that he had wound over four hundred feet. During all this time the spider remained perfectly quiet, but at the end of the time summarily stayed proceedings by grasping the line with one of her feet and snapping it. This might be called literally getting to the end of one's rope.

Another officer interested in the subject at the same time, fixing a number of spiders stationary by means of pins placed one on each side at the articulation, constructed a cylinder worked by a crank, and thus reeled the beautiful golden silk upon hard rubber rings making very pretty ornaments. To ascertain how much silk could be obtained from one spider, one of these little machines was turned at the rate of 160 revolutions a minute about twenty minutes each day for three days, and thus 4107 feet were reeled from a single spider. This was all that could be obtained in this particular instance; on killing the spider, however, plenty of the viscid fluid was found in the sacs, the conclusion being that it requires some degree of preparation after it is secreted before it is fit for use as silk.

Experiments were also made on the strength of the silk. It was estimated that a bar of spider's silk one inch in diameter would sustain a weight of seventy tons, while a similar bar of steel wire will sustain a weight of only fifty-six tons.

But I have already kept you too long. I thank you for your attention, and if I have given you but a small part of the entertainment in hearing my lecture that I have enjoyed in preparing it, as a rest from care and labor in another direction, I shall be glad that I delivered it.

As I have been writing it, I have compared spiders with human kind and have been struck with a difference and a resemblance. The difference is that all spiders are industrious. They are all willing to work, and do work hard for a living. They have an aim in life. Among the whole tribe there is not, to my knowledge, a "Charity Organization Society," and I doubt, should there be one, whether any spider of my acquaintance would apply for aid.

Another comparison may be made which is more favorable to the human race. The reeling of silk from the spider is not unlike the way in which force and vitality are drawn from overworked literary, professional, and business men. The pupils draw on the teacher; the demands of business on the business men; the omnivorous publishers on the literary author; the good people and the bad on the minister; the client on the lawyer. Given a fair education, and much of the work the live American does must be spun out of himself. If he be a useful and popular spider, the insatiable public, like Oliver Twist, cries for "more." But the reservoir at last runs dry; the vital force fails; the material for the silken web of thought is no longer secreted; there is paralysis, or cerebral lapse, or old age; and like his eight-legged Charleston friend, he says "thus far and no farther," grasps the line, snaps it, and is seen and heard no more.

A CRUISE IN THE WEST INDIES.

By CAPT. E. O. MATTHEWS, U. S. N.*

As a penalty for having presented a jar of nutmegs from Trinidad to the Society, I have been asked to say something about the islands I visited during my late cruise. The nutmegs in the jar before you grew on trees very much resembling our peach though much more shapely. The fruit looked like large, handsome nectarines. Within the outer hull comes the mace laid closely around the shell containing the nutmeg proper. These have been preserved in brine for several years.

In the spring of 1882 I was directed to visit certain of the West India Islands with my ship, and, as these are out of the ordinary lines of travel, I will endeavor to give a hurried sketch of the islands and places as I saw them. The City of San Juan de Porto Rico has a fine secure harbor, the entrance to which was strongly fortified by Poncé de Leon. It is connected by several lines of very poor steamers with the rest of the world, and by a tramway with Rio Pedras, from whence fine carriage roads lead to all parts of this beautiful island. Porto Rico is generally high and healthy, and with a good government could be very productive. It is now under Spanish misrule, when every industry is taxed to the utmost. It is the old story of the goose and the golden egg. There are many large and very valuable sugar estates, some of which I visited and found many of the modern improvements had been introduced. A very good quality of tobacco is grown there.

We made a short visit to Samana Bay, where it may be recollected that a few years ago this country came very near becoming involved in a gigantic fraud through the influence of some interested parties. But it rained about all the time we were there so that, aside from the official visits, I had but little opportunity for sight-seeing. The whole of this end of San Domingo is exceedingly fertile, but for want of a government there is but little done with it. When I was there some English engineers were surveying the valley of the Yuna with a view to running a line of railroad to St. Iago. But in some places along the river they found that their piling would have to go more than 100 feet deep.

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Our next port was Frederichstadt in the island of Santa Cruz, one of the Virgin group. It is under Danish rule and was just then recovering from the effects of a negro insurrection, in the course of which the principal sugar estates were burned over, and nearly all their stock of old Santa Cruz rum was lost. In place of rebuilding the old sugar mills, there is now a central steam mill near Christianstadt, which is connected by a four inch iron pipe with the juice vats on all the principal estates, so that all that the planter does is to crush his cane, running the juice into these large vats where it is mixed with a sufficient quantity of lime to prevent fermentation. The boilers for running the crushing mill are fired from the megasse, or crushed cane. The great trouble in this system of making sugar is in freeing the juice from the lime.

To break the monotony of life in these islands they have an occasional hurricane or tidal wave. In 1867 or 8 one of our men-of-war was lying quietly in the harbor when within a few minutes she was thrown several times around at her anchors then landed high and dry up in one of the streets of the town parallel to the water front and some distance back from it, having passed over, or around some low houses. It was only a tidal wave.

Leaving Santa Cruz we ran along to the eastward to Guadeloupe, which is one of the chain of beautiful islands known as the "Leeward" and "Windward" or "Caribbee" Islands, which separate the Caribbean Sea from the Atlantic Ocean on the east. Geologically these islands are, I believe, entirely separate from the rest of the West Indies. They are nearly all of volcanic origin, with shores descending abruptly into the Caribbean Sea, while into the Atlantic the descent is much more gradual, so that on this side we find a second distinct group of islands built up mainly of corals and shells.

Guadeloupe belongs to France and really comprises two islands, Grande Terre belonging to this organic group, and Basse Terre which is volcanic. This latter island we visited; it is very high, and beautifully wooded. There are three excellent roads, which lead through most enchanting scenery. Large quantities of coffee, sugar and cocoa are grown on the island. The coffee plant is allowed to grow about five feet high and then trained out flat on poles. The whole protected from the fierce tropical sun by large trees of a very rapid growth. The health of Basse Terre is good, though all kinds of malarial fevers abound at Pointe à Pïtre in Grande Terre.

A few hours' run from Basse Terre brought us to Roseau in Dominica, which is probably the loveliest of all these beautiful islands. The cliffs near the sea are chiefly composed of vast masses of conglomerate. In many places along the coast, beds of coral are found lying in the conglomerate rock at a height of several hundred feet above the sea. The island is high, Morne Diablotin reaching the height of 5,313 feet, while several others are over 4,000 feet high. Everywhere you find evidences of the subterranean fires, such as volcanic springs, boiling lakes, etc., around nearly all of which are large accumulations of sulphur. This is particularly the case at the southern extremity of the island, where there are several volcanic fissures. Near one of these springs, in the center of what was evidently an old crater nearly two miles in diameter, I saw a spot of white earth, about three feet square, out of which four pine apple plants were growing, and by sticking my cane down and withdrawing it, a jet of steam followed.

The rainfall at Morne Bruce (the military station) has reached as much as seventy-two inches in a year. Yet with all this rain and the heat, one cannot help being struck with the wonderful luxuriance of the vegetation, and, for a tropical climate, with the great variety of flowers. There are more than one hundred and fifty different kinds of useful woods on the island. Coffee and sugar were produced here, but a blight came on each—disease on the coffee, and competition from districts more favorably situated for the application of modern improvements has rendered the sugar cane culture non-paying in this very uneven island. Limes and cocoa are now the principal products. There can be few things more beautiful or fragrant than a lime orchard. The trees are filled with fruit and blossoms all the year round, so that they are at all times gathering limes, though principally in May and

June. The juice is pressed out and then boiled down to one-twelfth its original bulk, when it has the consistency of tar, in which condition it is shipped, largely to Philadelphia.

The island belongs to England. The population is decidedly mixed, and I am happy to say that the 14th amendment principles are cordially observed throughout the island. The people in all of these islands are very hospitable, and, as in all tropical countries, exceedingly fond of dancing, which is always to the quickest time. Between riding, dancing and dining we had but little time left for sleep.

On this island are to be found the last of the original Carib Indians, at least among the islands. There are only about one hundred and eighty of them. They have a settlement by themselves on the eastern side of the island, and are very orderly and quiet. They maintain themselves by cultivating the soil and making baskets and hammocks.

It may not be uninteresting to have a brief notice of them from that given by a French priest about two hundred and fifty years ago. They claimed to have come from the mainland of South America in many hundred canoes, and after eating all the men they married all the women. This claim seems to receive some support from the difference in the language of the men and women. They were remarkable for activity and courage, and were not so savage and brutal as their cannibalistic ways would lead one to suppose. They only ate their enemies killed in battle and this by force of habit, just as the old Aztecs looked with longing eyes for their perquisites in the sacrificial human roast. Upon their first contact with the Europeans they appear to have been a simple, hospitable and unsuspicious people. But the reply of a chief to the French governor of one of the islands tells but too truly the sad tale of their transformation. " You have stolen our lands and those of our neighbors; you have violated our wives, massacred our people, desolated our homes and committed unheard-of cruelties for the lust of gold." Believing in a supreme being so good that he would do them no harm, they only sacrificed to propitiate the evil powers; and all their idols such as found in the caves of Luquillo in Porto Rico are of the most horrible form. They practiced polygamy, esteeming it a distinction to have a large family.

They were fond of feasting and at the feast the host took his seat near the door with his war club in readiness to preserve order among his guests in case of need. What a splendid idea for some of our social gatherings, to have a man similarly equipped to preside over the supper table and keep the gourmands away while the gentlemen help the ladies!

Martinique and St. Lucia the next islands in order going south are said to be the only ones in this chain where venomous reptiles are to be found; and in these two they abound. In Martinique I was told that but few of the old residents had not lost a relative from snake bite, the Fer-de-lance, *Craspedocephalus lanceolatus*, (so-called from the shape of its head) being the most common. At St. Lucia the death rate from this cause alone used to be over thirty per annum; but by great care and rewards the administrator told me he had managed to reduce it to eleven for the last few years. In attending a picnic at St. Lucia after the ground had been carefully beaten over by the natives all the day before, I went to spread a shawl for a lady and in doing so killed a tarantula the size of a large saucer. I also found a freshly shed skin of a fer-de-lance as also a black scorpion, which is considered almost as bad as the snake.

A peak at the north end of the island of St. Vincent served as a safety valve for all this region when so much disturbed by earthquakes, about 1812, the whole of the top of the mountain being blown away, and in its place we now find a lake nearly two miles long and 1700 feet above the sea. The harbor of George's, in the island of Grenada, is but an old crater, and, as late as 1840, it was for some time a seething chaldron.

Leaving these islands we went to Trinidad, which appears to have been separated from the northeast corner of South America by the wash of the Orinoco. The island is nearly square and contains about 1800 square miles. The northern edge is high. The products of the island are sugar, coffee, cocoa and rice. The demand for labor in this hot, unhealthful climate is largely supplied by coolies from India. At Port of Spain, the capital, is a very large and interesting botanical garden. There are a number of mud volcanoes on the island that I was unable to visit; but I did visit the Pitch Lake of La Brea on the southwest end of the island.

It differs, however, very much from the descriptions I have found in various books. It was not boiling or in the least warm. Only some half dozen or so places were soft and we could run across all but one of them. In that one we found an alligator just "awash." The surface had the appearance of immense mushrooms or bubbles forced up from below. Where they met, the crevices were filled with water. There were a number of little islands in the lake covered with most luxuriant verdure and many large trees. All the surroundings of the lake, though covered with pitch nearly a foot deep, are well wooded. This lake is supposed to be the result of the deposits of wood brought down by the Orinoco, which have been converted by heat, etc., into pitch, which oozes up from below at this and many points around the island.

We next visited La Guayra on the coast of Venezuela. It is the seaport of Caracas. By the direct road from La Guayra to Caracas you have to ascend 5,000 feet, and come down 2,000 feet in order to reach the place. Thus Caracas is 3,000 feet above the sea and very prettily situated with extensive views in three directions. A railway was then in course of construction to connect with La Guayra. This is a great coffee growing country but owing to the expense of getting it to the coast it is hard to find a market. The best coffee is grown at the greatest height, the only limit being not to get so much in the clouds that there will not be sun enough to ripen it.

As with about all the Spanish speaking countries, stability of government is the one thing needful. President Blanco has done a great deal to cultivate a national feeling. He has a parliament where the representatives meet and discuss the affairs of the country. But after all he is dictator. He is the one man of whom all the other aspirants stand in awe. He has established a very handsome portrait gallery of all those who took a prominent part in the struggle for independence. He has erected public buildings, monuments and statues and laid out public gardens, and these latter are very beautiful. The people of the country are said to be exceedingly honest and hospitable ; that a person may travel from one end of it to the other with a bag of gold without the slightest fear of robbery. But the politicians, as they are called, are the disturbing element. The climate here during six months of the year is delightful and the nights always cool. The country is healthful.

Touching at Porto Cabello, we then passed by several phosphate islands to Curaçoa, which has been heretofore the great center from which merchandise was distributed to the South American coast. The make up of these islands (sometimes called the Lesser Antilles) is organic.

SOME OF THE BIVALVES OF NEWPORT.

By S. JACOB.*

I had hoped to place before the Society one or two new varieties that I had found on my previous visits to the beach, but having forwarded the specimens to Europe I have been unable to find duplicates, and my subject being a very long one I am reluctantly compelled to confine myself to the following well-known varieties. I say reluctantly from the fact that the varieties exhibited have been known to students of conchology so many years that I am afraid not very much that is new can be said in regard to them. But thinking established facts might be of interest to the Society I have prepared this paper.

Acephalous mollusks with bivalve shells is the name given by modern naturalists to the order of animals of which I have now to speak. The word acephalous comes from the Greek and means headless. I have specimens here of *Ostrea edulis* or edible oyster, *Mytilus edulis* or edible mussel, *Pecten pleuronectes* or flounder scallop, *Pecten latiauratus* or dancing scallop, *Solen ensis* or razor shell, *Venus mercenaria* or quahaug, *Mya mercenaria* (*M. arenaria*) or soft clam, *Mactra gigantea* or deep sea or beach clam and a fresh water *Unio* from Easton's Pond.

The American oyster, having gained such a world wide reputation, has led me to devote most of my paper to that animal and to occupy most of your time with details as regards him. It is described by conchologists as follows:—Animal; body compressed, more or less orbicular, edges of the mantle thick not adhering or retractile, and provided with a double row of short and numerous tentacular filaments; two pairs of elongated and triangular labial appendages; a subcentral bipartite muscle. Shell; irregular, inequivalve, inequilateral, roughly foliaceous, the left or inferior valve adhering, larger and deeper than the other, its summit prolonged with age into a sort of heel; the right or superior valve more or less operculiform; hinge oval, toothless, ligament subinterior, short, inserted in an oblong cardinal cavity increasing with the summit; muscular impression single and subcentral.

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*Read before the Society April 8th, 1885.

There is a wide difference of opinion as to the known varieties of the oyster family. Defrance enumerates one hundred and twenty species, Lamarck thirty-three fossil and forty-nine living. A book might be written about the historical associations of oysters; much, too, might be said about the oyster beds and fisheries, which give employment to thousands of our industrious population; but all this has so little to do with natural history, that I can find no excuse for dwelling upon it here. A curious feature in regard to the family of bivalves is the fact that most of their shells are broader than long. Take for instance the razor shell and then look at the mussel, the why and wherefore of this leaves room for endless discussion.

The anatomical structure of the oyster is more nearly perfect than would be supposed, from its apparently low state of organization. It has a heart, liver and intestinal canal, and a bag near the mouth, which answers the purpose of a stomach. Its breathing organs are gills, closely resembling those of most other fish. It has little vessels which convey the bile from the stomach to the liver, and may, perhaps, be subject to bilious attacks as well as those who swallow this curious piece of organization at a mouthful, without thinking at all of the goodly structure they are demolishing. There is the living heart with series of blood vessels, just as perfect as in the larger animals. There are the nerves in the shape of minute feelers, which appear to be acutely sensible, not only of actual contact with foreign bodies, but also of sounds and movements from without. A very nice sense of feeling appears to reside in the beard, in scientific language byssus; this is a kind of double fringe to the two lobes of the mouth, or sac, as it is called, which envelops the body of the animal, and floats free from the shell, except just at the part nearer the valve where it is attached. The muscular impressions left on the inside of the valves by the adhering muscles of the animal, are known in the oyster, mussel, etc., as having but one impression and are described as belonging to the class Monomyaria, this being known as the abductor muscle. During the life of an oyster the usual and natural state of the shell is that of being kept open for a little distance, to allow the water necessary for its nourishment and respiration to flow in and out; but as a security against danger, it was necessary to furnish the animal with the means of rapidly closing the shell, and retaining the valves in a closed state. These actions being only occasional, yet requiring considerable force, are effected by means of a muscular power, for which purpose one or two, or sometimes more, strong muscles are placed between the valves, their fibres passing directly across from the inner surface of one to that of the other, and firmly attached to both; these are called the abductor muscles, because their office is to draw or pull. How strongly they do this, those whose business it is to open oysters can best tell. If the animal within were not alive, the process, of course, would not be a difficult one, as in that case the muscles would be relaxed and the shell would come open of itself. The two portions of the shell are joined together by a hinge, it is mostly formed by the teeth of one valve inserting themselves between those of the other, or by the teeth of one valve fitting into the cavities or sockets of the opposite one. Upon the number and relative situation of the teeth principally depend the specific distinctions. When hinges have no visible teeth they are termed inarticulate, as the oyster. The hinge of the oysters is formed of the inner layer of the shell, and strengthened by a ligament which is wonderfully elastic. When the shell is drawn together by the abductor muscles, the ligament is at full stretch, and as soon as they relax at all, it contracts, and causes the shell to gape. This process is repeated as often as may be necessary for the safety and sustenance of the animal within, whose mouth is situated at the narrowest part of its habitation—namely, near the joint of the hinges which connects its upper and under shell. Truly the oyster may be considered the monarch of bivalves. His palace, to be sure, is somewhat rough and rugged outside, but within, its walls are smooth and polished, lustrous and iridescent, and altogether beautiful, of a nacreous or pearly appearance, now flushing into a rose tint, now fading into a pure white, and adorned sometimes with goodly pearls of price. Truly this monarch of the conchifers has a habitation worthy of a prince, wherein he lives in right royal state. You may smile, perhaps, at the idea of the solitary oyster doing this, down there on his mud bank or rocky anchorage ground, shut up in his dirty looking shell, and holding, as it seems, commune with no one, not even his fellow mollusks. How can he be said to live in royal state, or, indeed, any state at all, except in a most weary, stale, flat and unprofitable one. And this only shows how erroneously we often judge, when we do so hastily, and from first appearances. If we use a microscope we shall see that the shells of the oyster family differ from other bivalves, they being a world in themselves occupied by an innumerable quantity of animals compared to which the oyster itself is a colossus. Modern naturalists say that the liquid enclosed between the shells of the oyster contains a multitude of embryos, covered with transparent scales, which swim with ease; a hundred and twenty of these embryos, placed side by side, would make an inch in breadth. This liquid contains besides, a great variety of animalculæ, five hundred times less in size, which give out a phosphoric light. These are not the only inhabitants of this dwelling—there are also three distinct species of worms. By the aid of an aquarium it can be positively seen that the oyster is by no means solitary in his bivalve palace as might be supposed. He has his torch-bearers and other attendants, quite a host of them, magnificently dressed, and well instructed in the several duties which they have to perform. Yes certainly as the Irish poet has said—

> "Of all the conchiferous shell fish,
> The oyster is surely the king."

The "spat" or spawn of the oyster is cast about the middle of May; at first it resembles a drop of greenish tallow, but by the aid of the microscope it may be seen to consist of a great number of minute particles, each of which is an egg. These increase in size very rapidly, and after floating about for a while, sink to the bottom, and become attached to rock or some other substance, in which position, if not violently detached or removed, they complete their growth and live out the term of their natural life. They feed on minute animalculæ and microscopic vegetation, on the nature of which their flavor greatly depends. Aside from man who is their greatest enemy there is the star fish, whelk, crab and the large drum fish, which swallow them almost by the bushel, shells and all, and the oyster fisherman is patiently waiting for the inventive genius who will show him the way to protect this delicate morsel for the sole use of the highest order of animal life, but so far the oyster has declined to become party to any such monopoly.

Mytilus edulis.—Of this family there are forty-two known and described species. The edible mussel is found in great numbers on most rocky coasts, where facilities are afforded for the mollusks to moor themselves to rocks, stones and other substances covered at high-water, but left dry by the retreating tide. They are not, however, confined to shores of this description, but are sometimes found in vast numbers on low sandy or pebbly flats, which run far out into the sea. These are called beds of mussels. In Europe where the mussel is appreciated as an article of food these beds receive the same cultivation and protection as oysters. As a ship by its cable, so commonly the mussel, by its byssus or beard, is made fast to its anchorage-ground be it pebbly or sandy beach or jutting rock. Its greatest peculiarity is its manner of locomotion; it has a short, fleshy foot, in shape something like a fat baby's, and this it can advance about two inches beyond the edge of the shell, then fixing the front of it to a piece of rock or any other body, and contracting it, the shell is drawn onward, and sure, though slow, progress is made in any desired direction. There is a vast deal more to say on the Mytilidæ family, but having used so much time in connection with the oyster, a great deal of which is applicable to all bivalves, I must pass rapidly over this and the following varieties.

Pecten pleuronectes or flounder scallop.—This is remarkable for having the two valves of the shell of different colors, the upper ones being of a rich reddish brown, and the lower one white. There are sixty-seven described species, and according to Defrance ninety-eight fossil. This family are noted for their ears, the processes on each side of the beak. Some have one ear very large and the other small, and some are scarcely observable on one side, the superior ear being the large one and the inferior the small one.

Pecten latiauratus or dancing scallop.—The action of the abductor muscle gives this scallop the appearance of dancing on top of the water and it is wonderful to watch their endurance and see the distance they can travel in a short time. This is the edible one for which certain parts of our neighborhood have become noted. It has long been a matter of contention among writers as to which was the species worn by the Pilgrims to the Holy Land. Sir Walter Raleigh in his poem "The Pilgrimage" thus refers to it —"Give me my scallop shell of quiet." It is now generally conceded to my namesake, *Pecten jacobæus* which is found at the present time in such immense quantities on the British coasts.

Solen ensis or razor case.—Animal; body cylindroid, much elongated, the mantle in form of a canal open at both ends, closed in the rest of its extent by a thick epidermis which surrounds it, a cylindroid anterior foot; shell; equivalve, extremely inequilateral, the summits very small, and entirely at the commencement of the dorsal line, one or two teeth in the hinge. There are twenty-one known and described species, six of which are found in America. This shell has become famous on account of the many names it has received. Among numerous others it has been called *Siliqua costata*, by Adams in 1858. It was named *Leguminaria* by Schumacher in 1817, and *Machæra* by Gould in 1841, the latter name is, moreover, pre-occupied by Cuvier, in 1832.

Venus mercenaria or quahaug belongs to the class Di-myaria, it having the two muscular impressions of the abductor muscle. To shorten my paper I will leave out the description of the animal inhabiting this and the two following varieties and confine myself to the shells. Solid, thick, regular, perfectly equivalved and close, more or less inequilateral, summits well marked and inclined to the front, hinge sub-similar, the middle cardinal tooth forked, or three cardinal teeth more or less contiguous and convergent towards the summits. There are known one hundred and twenty living species, and nine fossil, twelve being found in American waters.

Mya mercenaria, *M. arenaria* or soft clam.—I have used two names here because the United States fish commissioner's report used the name M. arenaria, and Sowerby claims that the arenaria is unknown in American waters and that it is Mya mercenaria. The shell is surrounded with a thick epidermis, which is prolonged upon the tubes and edges of the mantle of the animal, tolerably solid, with fine trenchant edges, the summits very little marked, hinge dissimilar, one or two oblique cardinal folds, divergent, behind a horizontal spoon-shaped hollow apron, the left valve corresponding with a hollow horizontal and cardinal in the right valve, two distinct muscular impressions. Ten species, of which four are American. I have had several conchologists in Europe ask me if it were really true that this species was eaten in America. I have always referred them to a Rhode Island clam bake.

Mactra gigantea or deep sea clam.—The Mactra has a peculiar hinge distinguishing it from all other genera. It is triangular, with a curved or angular compressed tooth on each valve, with a small oblique cavity on each side, to which is attached the ligament. Two lateral teeth, one near the primary tooth and one near the ligament. The shape of the shell is subtriangular or oblong, exterior smooth, straited or ribbed transversely, two muscular impressions united by a narrow marginal tongue. Forty-four species, thirteen of which are American.

In conclusion I would call your attention to a specimen of the fresh water *Unio* from Easton's pond, and also to an oyster shell, the property of a gentleman here in town, who has been kind enough to loan it to me for this occasion. It is undoubtedly the most patriotic shell in existence and the owner values it accordingly. It has the letters U. S. perfectly formed by the *Serpula contortuplicata.*

THE EVIDENCES OF GLACIATION ON MOUNT KEARSARGE, N. H.

By BAYARD T. PUTNAM.*

A line drawn through Nantucket, Martha's Vineyard, Block Island and Long Island, thence across New Jersey and Pennsylvania to a point near the centre of Cattaraugus County, New York, and thence following, very roughly speaking, the Allegheny, Ohio and Missouri River valleys to the plains of Dakota, would indicate the southern limit of glacial drift and striated ledges, and therefore the edge of the glacier of the ice period, at the time of its greatest extension. From Cape Cod to Western Ohio this line has been carefully mapped, and it is marked almost continuously by accumulations of drift, differing in many respects from the hills of till away from the ice margin. These accumulations are believed to have been piled up under the comparatively thin edge of the ice, partly by the ice itself, partly by sub-glacial waters. They are, in other words, the terminal moraine of the glacier.

When typically developed, as it is on Cape Cod, the moraine forms a range of short, knobby, steep-sided hills, rising from 50 to 200 feet above the general level and enclosing round, oval or irregular shaped depressions, which are sometimes called pot holes or kettle holes. The typical kettle hole is nearly circular, its sides make an angle of 30° or 35° with the horizon, and it is only a few hundred feet or less in diameter. Genetically, however, this form cannot be distinguished from the irregular depressions a mile or so across, which often form lake basins without outlet.

In Wisconsin there are a number of kettle hole ridges very noticeable in the otherwise flat country, which have recently been identified by Professor Chamberlain† as forming a portion of the terminal moraine of what he considers to be a second and later continental glacier. Professor Chamberlain has identified the line of this moraine from Cape Cod to the Canadian boundary in Dakota, and Dr. Dawson has identified it for 400 miles beyond. This later moraine crosses the Northern States of the Union in twelve great loops, each of which embraces a distinct valley ; and these loops are believed to have been formed by lobes of ice advancing through the valleys from the front of the ice sheet.

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*Read before the Society April 9th, 1885.

†Third Annual Report of the U. S. Geological Survey, 1881-2.

In the West the limit of glaciation extends for hundreds of miles beyond this moraine ; but in the East the Champlain-Hudson River lobe is believed to have formed the Cape Cod-Long Island moraine. In other words, while in the West the glacier of the second epoch was not so extensive as that of the first epoch, at the East its frontal edge reached the same or possibly a lower latitude. The second moraine is much more massive than the first, and the country back of it gives evidence of much more thorough glaciation than does that lying between this moraine and the limit of drift.

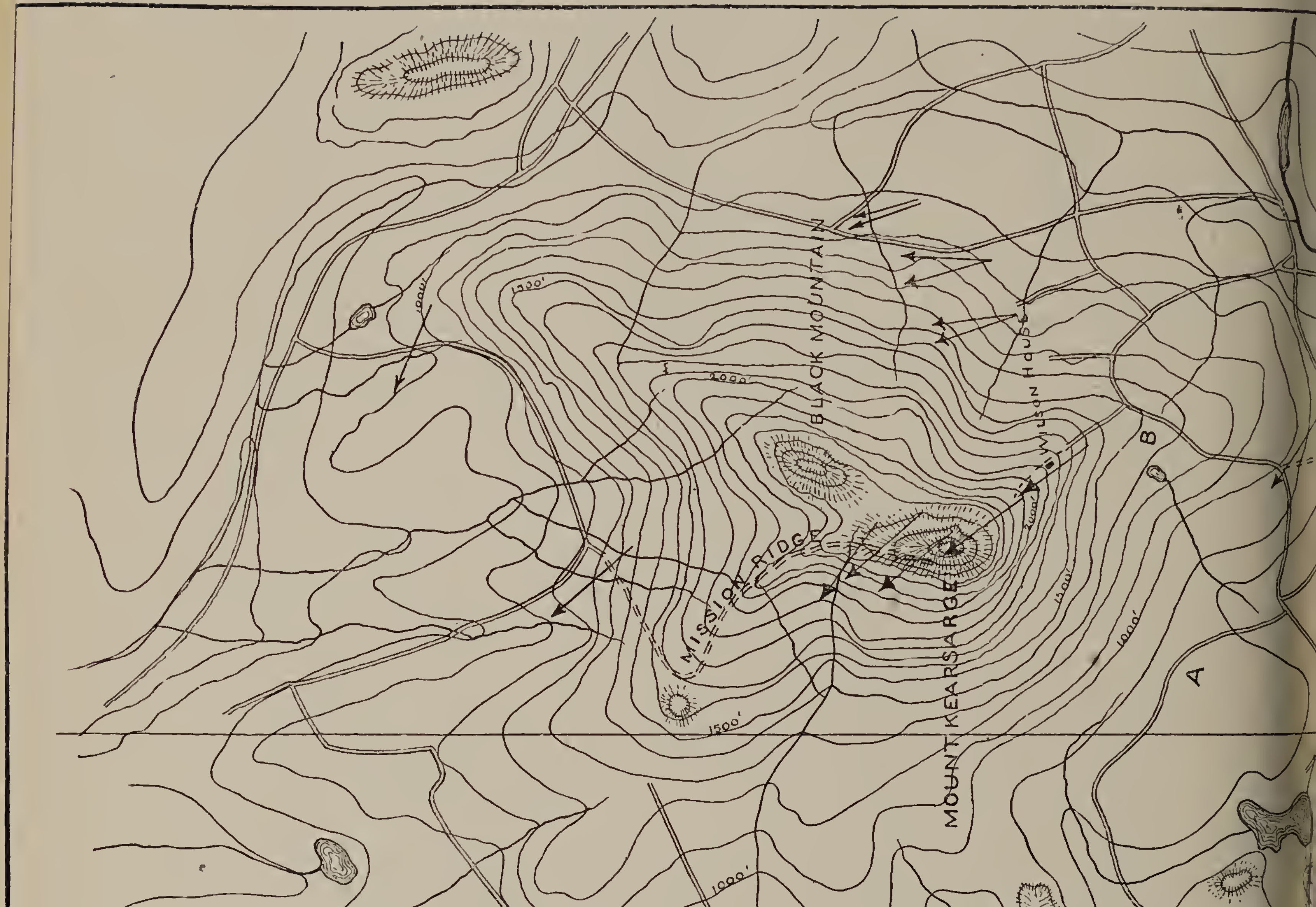
At the time that the moraine was being formed on Long Island, New England was completely buried under an ice blanket which must have been fully a mile thick in Northern New Hampshire. So far as recorded the summits of all the New England mountains are glaciated. And it is readily seen that this would necessarily have been the case if the upper surface of the ice was (as it is supposed to have been) a plane with a gradually upward slope from the sea at Cape Cod to a point somewhere above the summit of Mount Washington.

The Adirondacks, like the White Mountains, were completely covered with ice ; but the summits of the Catskills above about the 3000-foot contour are not glaciated. Some points in the New Jersey highlands a short distance north of the moraine rose, also, above the ice. These data, together with the position of the terminal moraine at tide water at Perth Amboy, have furnished Prof. Smock with the means of estimating the grade of the glacier's surface. Between New Jersey and the Catskills the average upward rise was thirty feet per mile. These figures, though indicating a grade very much less than that of any alpine glacier, accord well, not only with Geikie's estimate of the grade of the surface of the Scotland glacier, but also with Nordenskiold's figures of the rise of the surface of the ice towards the interior of Greenland.

Nordenskiold found that, after getting upon the surface of the glacier, the rise was thirty-six feet per mile for the first forty-two miles; then at the rate of twenty-six feet for twenty-eight miles; then twenty-two feet for thirty-seven and one-half miles; then nineteen feet for fifty miles and finally twenty-two and one-half feet for the last seventy-five miles before he turned back. The New England landscape, if such it can be called, was then, in glacial times, extremely monotonous—an essentially level white plane cut here and there by deep crevasses down which the surface rivers precipitated themselves, perhaps three or four thousand feet at one leap.

The effect of this immense mass of moving ice upon the surface of the country is still a question upon which extreme views are held. But there is one feature which we unquestionably owe to it. I refer to the numerous lakes and lakelets which add so much to the beauty of our Northern scenery. The limit of glaciation could be laid down with considerable accuracy on a good topographical map by simply drawing a line to separate the lakeful from the lake-less region. These lakes were formed, in the majority of cases, not by any scooping action on the part of the glacier, but by the deposition of drift from the ice valleys, thus damming back the water. Since the retreat of the ice the streams have been constantly occupied in removing these accumulations or in cutting down new channels, and many large lakes, of which we are able to trace the shore lines, have already disappeared. But the ice age was too recent and the obstructions were too great to yet permit a return to complete drainage.

In some regions, too, the glacier benefited the land from the farmer's point of view. In Northwestern Pennsylvania and throughout Ohio the terminal moraine is almost the dividing line between cultivated fields and forests. Here the streams south of the glacial limits run in narrow ravines, 200 or 300 feet deep, cut in the horizontal Waverley and Coal Measure strata. These valleys in the glaciated region have been largely filled with drift, which covers Northern Ohio to an average depth of over fifty feet. The action of the glacier has here changed an almost cañon country into a rolling one. And in general the glacier seems to have had a subduing effect upon the topography.



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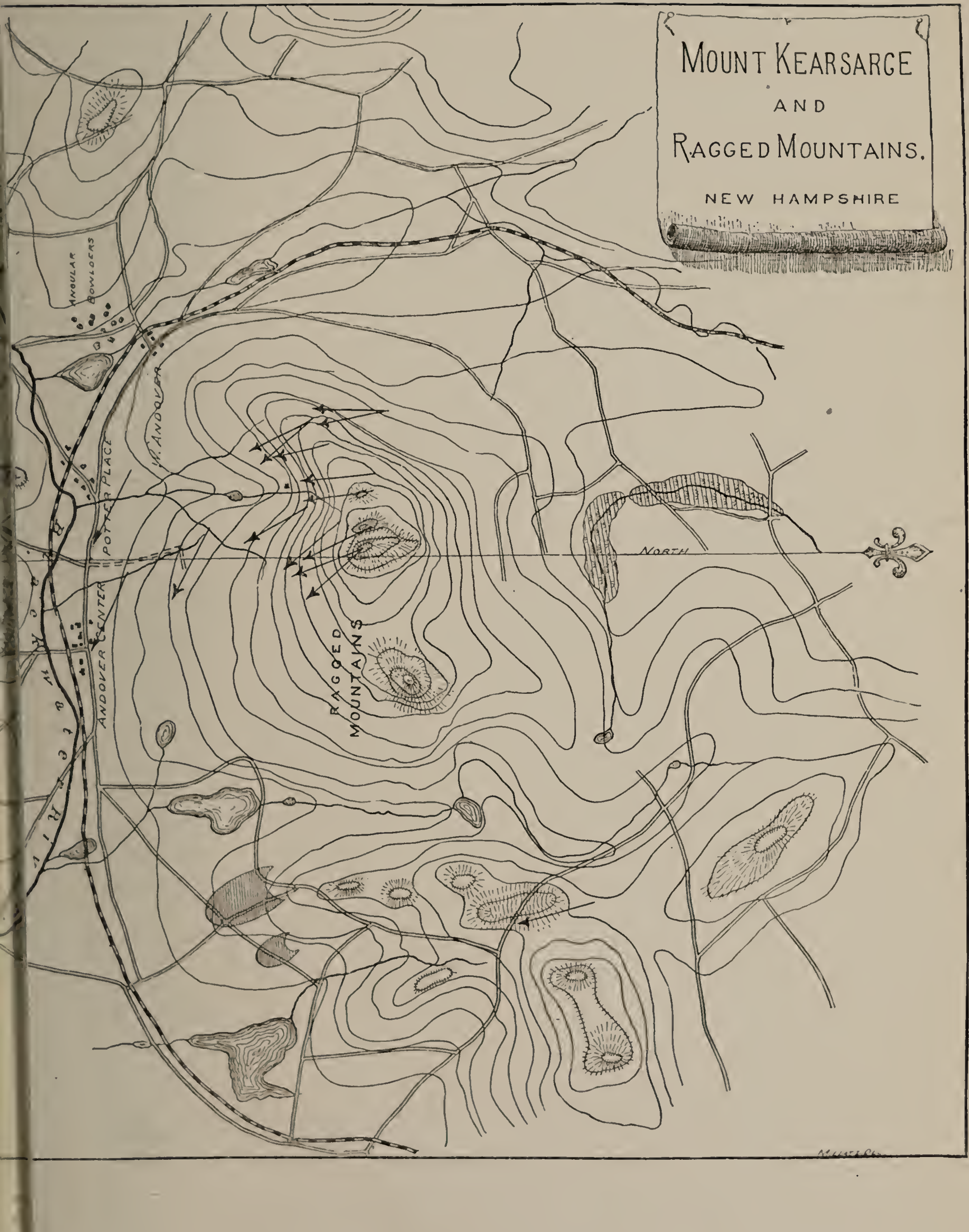
MOUNT KEARSARGE
AND
RAGGED MOUNTAINS.
NEW HAMPSHIRE
ANGULAR BOWLDERS
W. ANDOVER
POTTER PLACE
ANDOVER CENTER
RAGGED MOUNTAINS
NORTH

In the mountain region of New Hampshire the glacier swept the summits clean of all soil—the accumulations of untold ages of subaërial disintegration of the underlying rocks; for this part of the continent has been above the sea since early Silurian or pre-Silurian times. The action of the glacier here has been compared with that of a river in the rapid part of its course, and that in Ohio with the same river, clogged with débris, where its current has become sluggish. The one was a region of erosion, the other of deposition. This comparison must not, however, be accepted without some qualifications.

Mount Kearsarge,* in Merrimack County, New Hampshire, about 150 miles from the terminal moraine, affords an exceptionally favorable opportunity to study the action of the ice in a region of erosion. For it is comparatively isolated and the ledges have preserved the glacial striæ more perfectly than is usual.

Mount Kearsarge has an altitude of 2,940 feet above the sea, and some 2,000 feet above the surrounding rolling country. With the exception of Monadnock, thirty-eight miles distant in a south-southwest direction, there is no mountain of an equal height within the boundaries of New Hampshire, to the east, south or west. To the northward the country is more rugged, culminating in the White Mountains; but in this direction, the nearest peak of an equal altitude with Kearsarge, Mount Cardigan, is fifteen miles away. It happens from this, that while Kearsarge is but a hill when compared with the mountains further north, its surroundings give to it a prominence which some of the loftier peaks lack. Its summit is bare rock.

Geologically, Kearsarge is associated with Ragged Mountain, six miles north of it, and a trifle over 2,000 feet in altitude, for both mountains are composed of the same peculiar rocks; but topographically, the two peaks are entirely distinct, as they are separated by the Blackwater Valley, which here has an elevation of less than 700 feet above sea.

The Kearsarge rocks consist of highly tilted strata of a more or less siliceous mica schist with occasional quartzitic bands, the group being characterized by the presence of crystals of andalusite or fibrolite. This formation has in general resisted weathering, and thus has preserved the marks of the ice, to an exceptional degree. On removing the surface covering from a ledge in a glaciated region, glacial striæ are usually visible. But after a comparatively short exposure to the air, the surface of the ledge, as a rule, weathers and disintegrates, and all but the coarser markings soon disappear. The summits of Monadnock, Kearsarge and Ragged Mountain are, however, entirely bare, and yet the finer glacial markings have there been preserved with great distinctness. This is doubtless mainly due to the nearly complete absence from its constituents, of any easily alterable mineral, like pyrites or feldspar ; but the very thorough planishment of the surface by the ice, seems to have had, too, a preservative effect on the rock, by preventing the lodgment of surface waters. A specimen on the table illustrates this. It is apparently fresh quite close to its smooth side, which was the top of the ledge ; while along the opposite face, that was next a seam, there is a discolored band, indicating alteration, more than half an inch wide. It is not, I think, supposable that this seam existed in glacial times, for in that case the fragment would probably have been dislodged by the ice.

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*This must not be confounded with the mountain sometimes called by the same name, near North Conway, N. H.

Perhaps the reason why the summits of Kearsarge and Monadnock are treeless, is to be sought in this resistance to disintegration of the rocks which compose them. There is nothing from which a soil can be formed excepting in the crevices, where the action of surface waters may be brought into play. Such crevices contain grasses and shrubs—sometimes small trees. The summits of Monadnock and Kearsarge do not appear to be above the timber line of the latitude.

I have enlarged a fraction of the map published with the Geological Report of New Hampshire to show Mounts Ragged and Kearsarge on a scale of half a mile to the inch. The contour lines indicate vertical intervals of one hundred feet. The arrows show the direction of the glacial striæ at the points at which they are placed.

The road up Mount Kearsarge from the north side, follows a spur of the mountain that juts out in a northwesterly direction from the peak. This spur, as is shown by the striæ visible on the numerous planed and embossed outcrops, from the foot to the summit, was parallel to the direction of movement of the glacier. The striæ everywhere on the ridge point towards the summit. Their courses vary from S. 36° E. to S. 43° E. On the summit they run S. 46° E. On the north side of the mountain, that is, on the east side of the spur, the New Hampshire geologists have noted a direction of S. 76° E. and above this, and nearer the summit, I observed a S. 56° E. course. On the west side of the mountain, near its foot, striæ have been noted having the following courses: S. 8° E. to S. 21° E.; S. 9° E. to S. 3° W. and S. 11° E. Platting these striæ on the map, we at once see that where the slope of the surface was opposed at right angles with the unimpeded ice current (shown by the striæ on the summit), as it was along the axis of the ridge, it had no effect on the direction of the moving ice. For the ice was urged forward with such force that it overcame direct opposition and simply mounted the slope. But where the ice advanced diagonally to the plane of the slope it was more or less deflected away from the mountain. Thus on the northeast side of the ridge the striæ have more easting and on the southwest side more westing, than on the ridge itself. The deviation appears to have been about the same in each case, for the planes of the two slopes made about the same angle with the direction of the advancing ice. One result of the deflection of the ice by the ridge would, perhaps, have been to form wrinkles or corrugations, analogous to the waves formed by the prow of a ship, and in this case the forces acting to determine the direction of motion at the bottom of the glacier would be complex and probably variable. The direction of their resultant, along which the ice must at all times have moved, would then vary between certain limits. As a matter of fact the striations near each other on the ridge and on the summit are nearly parallel, while on the west slope, at all events, they often show considerable variation in course, on the same outcrop. For instance, the arrows joined at their feather ends on the map, below the Winslow House, show the extreme courses, of the striæ at these points. Many courses between the extremes are visible on the ledge—some crossing others. It would seem from the descriptions that crossed striæ sometimes occur on the summits of mountains, where this suggestion that they are due to variations in motion caused by immediate topographical conditions would not apply.

As soon as the highest point of the mountain was passed by the advancing ice, more and more ice was forced over the top of the ridge, that extends southwesterly from the peak, and finally the ice passed around its southern extremity. The deflection to the eastward at the south end of the mountain was caused by the difference in the pressure of the ice on the east and on the west. The ice was crowded around the mountain to fill up the depression under its lee, resulting because only a portion of its total thickness had passed over the summit. At the southern end of the mountain the direction of the striations is at one point S. 60° E.

The mountain as a whole seems to have had the same effect upon the moving ice, as a similar-shaped and submerged dam would have upon the waters of a somewhat rapidly moving stream. In the case of the stream, there would be quieter water under the lee of the dam, and like conditions appear to have existed in the ice stream under the lee of the mountain. The rocks there are, so far as observed, not embossed nor striated.

Besides the main deflection of the ice by the mountain, local deviations were caused by comparatively small irregularities of the surface. This is perhaps best seen on Ragged Mountain, which, as the name implies, includes several peaks. The highest one is on the east. It is not possible to show all the smaller deflections excepting on a map of very large scale, but some of them are clearly enough indicated on the map before you. For some distance west of the highest summit the courses of the striæ are more southerly than they are on the summit itself, excepting in the depressions or saddles between the different peaks. Here the effect of the elevation on the west sometimes overcomes, locally, the general westerly deflection. As we travel along the ridge, which curves around to the southwest, the striæ point more and more towards the east, but every little eminence has had its effect in producing a local deviation of the ice current. In the saddle between Mount Kearsarge and Black Mountain, the deflection, here easterly, amounts to ten or fifteen degrees as compared with that of the unimpeded ice current over the summit of Kearsarge. On the hill east of Bradley pond (southeast of Andover Centre), there is a like difference in course between the striæ on the summit and on the north flank. The striæ in the valley of the Blackwater, near

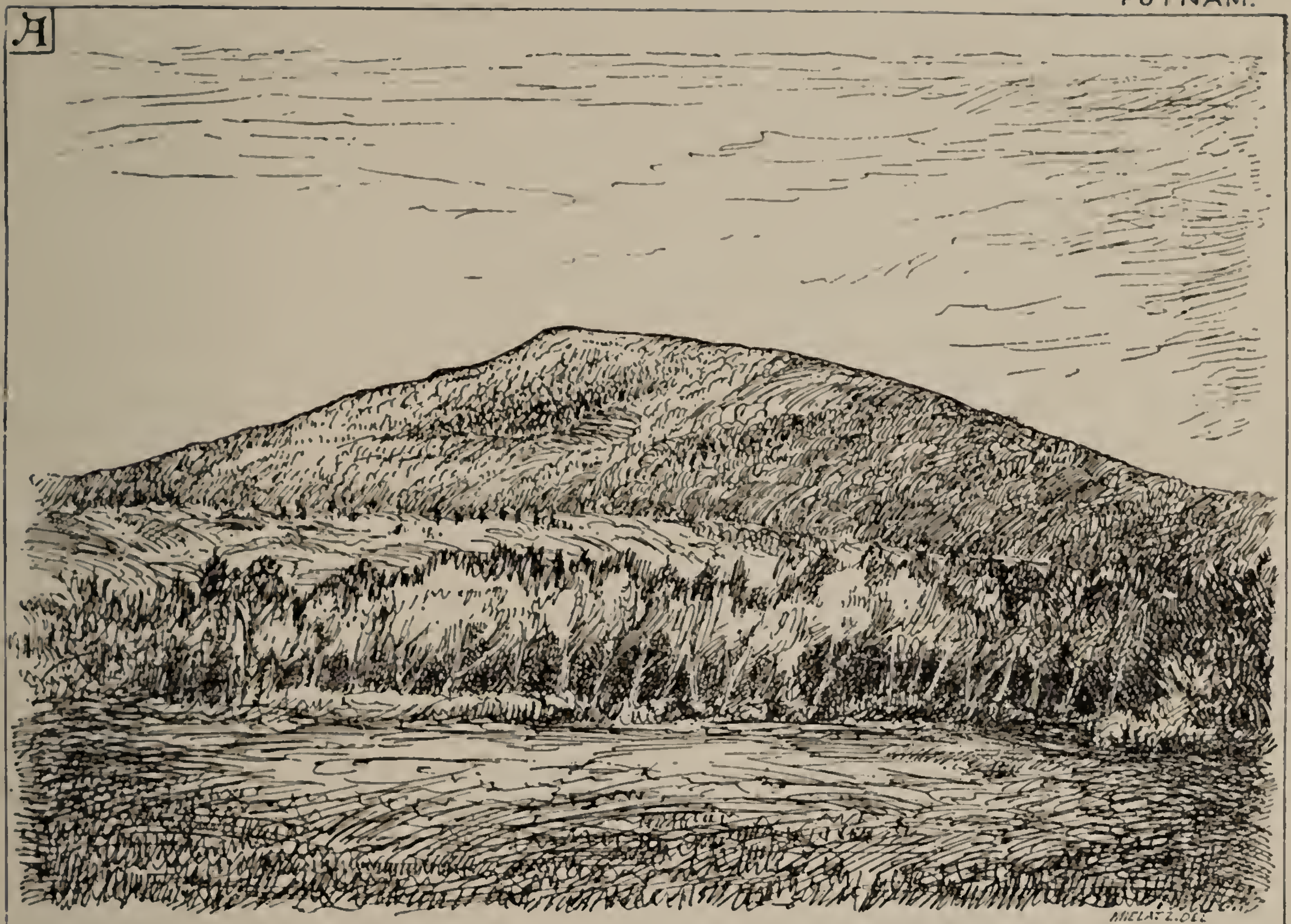
Potter Place and Andover Centre, point with the valley, and these have been thought to indicate a local valley glacier. But the gradual change in the direction of the striæ on the ridge, which I have already noted, leads me to believe that the supposition of a local glacier is unnecessary to explain the facts. Moreover, the striæ in the Blackwater Valley are very nearly parallel with those on the south side of Kearsarge, which certainly could not have been formed by a local glacier.

It seems to me, then, that all the striæ about Mounts Kearsarge and Ragged thus far recorded, are easily referable to a single great ice sheet moving in a southeasterly direction. In this view I appear to differ from the New Hampshire geologists; for in their report, not only are the striæ in the Blackwater Valley referred to a local glacier, but the southerly striæ on the west of the mountains are ascribed to a general southerly ice movement, subsequent to the southeasterly one, and we are told (vol. 1, p. 541) that during the later movement Kearsarge and Ragged stood up as islands in the ice sea. I do not wish to deny, on the strength of these few observations, the existence of this southerly movement, or of the Blackwater glacier, but only to point out that neither supposition appears to be necessary to account for the observed facts in the vicinity of Kearsarge.

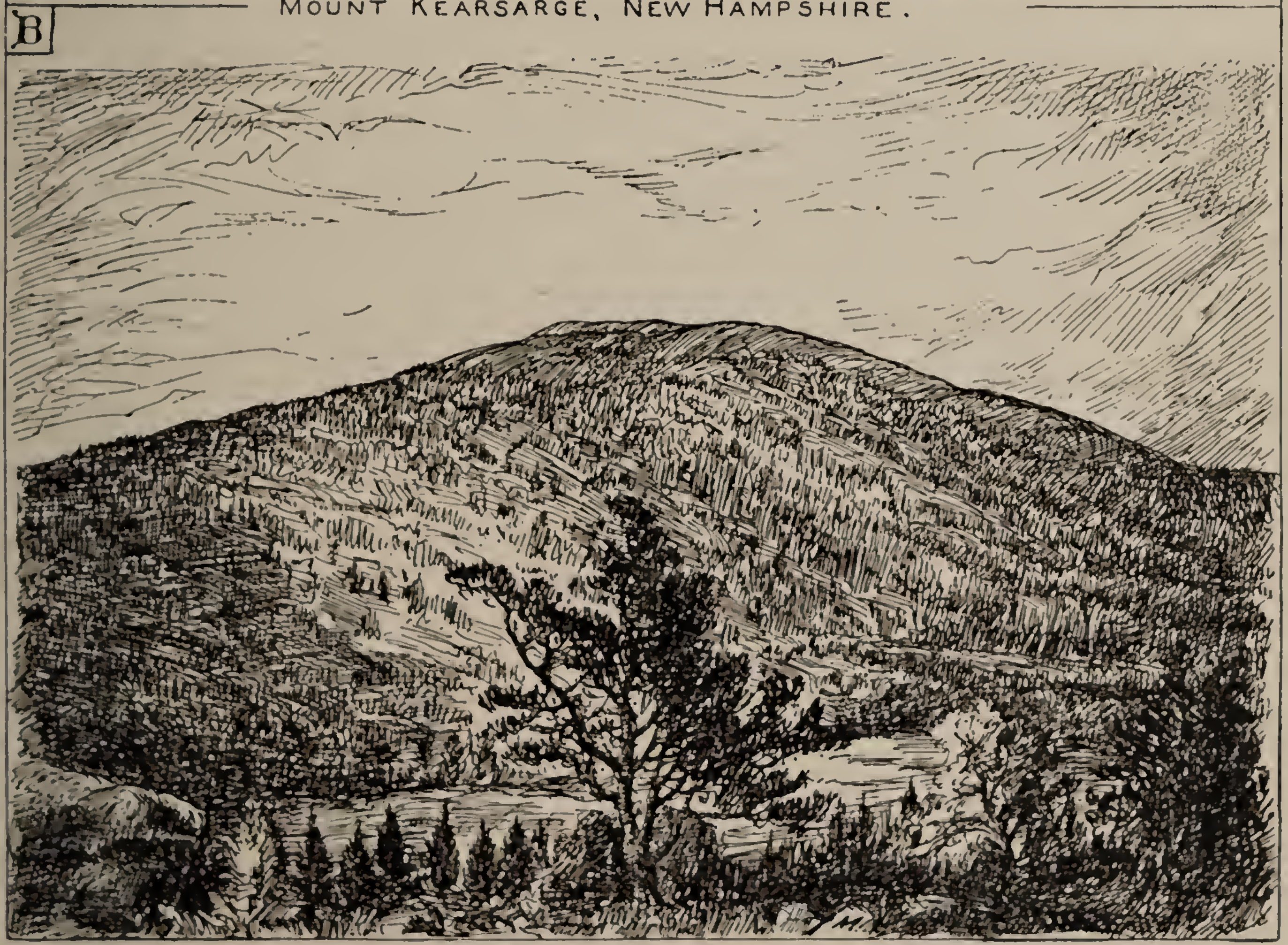
The deflection of the ice current by local topographical features has been observed almost everywhere where glacial action has been studied. My excuse for emphasizing it in these notes on Kearsarge is: first, because the action is there finely illustrated, and second, for the reason that, according to Prof. Hitchcock, topographical deflection is not commonly apparent in the glacial markings of New Hampshire. He says (Geology of New Hampshire, III, p. 202): "In our researches we have constantly asked, how do topographical features influence the course of striæ? The replies forced upon us insist that a portion of the directions is due to topographical features, while others—the majority—pursue a fixed course, in total disregard for all obstacles."

So much then for the rock striations. But these, though perhaps the most interesting, are not the most prominent glacial phenomena in the vicinity. The planishment of the ledges, especially on the summit, could hardly fail to attract the attention of the most casual observer, and the mountain, as a whole, as seen from a distance, shows plainly the effect of glaciation. I have made drawings of the profile of the mountain from two photographs, the one taken at B. looking towards the peak in a direction parallel to the ice movement, and the other taken at A. looking towards the summit in a direction at right angles with the ice movement. The vertical and the horizontal scales of these diagrams are equal, and the diagrams represent the upper 1,400 feet of the mountain, that is, the profile of the mountain above the 1,500-foot contour. The difference in the outline as seen from the two points of view, is very noticeable, more so, perhaps, than is indicated by the diagrams. For the eye naturally exaggerates the vertical scale of prominent objects: a mountain always seems to subtend a greater vertical angle than it really does, and a slope always looks steeper. The profile of the mountain from A., illustrates on a large scale the meaning of the words " stross " and " lee " as applied to opposite sides of glaciated ledges. The northwest—the stross-slope, and the southeast—the lee-slope, as seen from A. are very unlike. The former appears almost perfectly regular and smooth, while the latter is more or less jagged and rough. From B. the two slopes appear equally smooth, and the mountain is quite symmetrical—its outline resembling a slightly truncated cone. This shape is in nowise due to the filling up of hollows in the mountain side with drift. The profile would not be appreciably altered were all the surface covering removed.

There is no timber on the northwest ridge below the 2,000-foot contour, though it extends on either side much lower, and along the backbone of the ridge, as has already been mentioned, there are many planed outcrops. Between the 2,000 and 2,700-foot contours there is a belt of small timber, which contains, in places, large areas of polished and striated outcrops from which the thin soil has apparently been blown. Above the 2,700-foot contour, that is, for about 250 feet below the summit (on the north and west sides of the mountain) there is no timber and no soil. The top of the mountain is as clean as this floor, save in some of the crevices where sufficient soil has accumulated to partially cover the roots of low, scraggy pines. The area of polished rock exposed here is larger than I have ever seen elsewhere. It is over



MOUNT KEARSARGE, NEW HAMPSHIRE.



one-half mile long and fully 1,000 feet wide. The photographs give a better idea of the appearance of the mountain top than words can convey. The low trees all lean towards the southeast from the influence of the prevalent northwesterly winds, and this combined with the parallel striations in the same direction. give the beholder a very curious sensation of motion, as if he were standing on the edge of a rapidly moving flood. East of the summit, as soon as one is fairly under the lee of the mountain, one finds occasional boulders, but no planed ledges. The east side of the mountain is densely timbered, and has, as yet, not been thoroughly explored.

On Ragged Mountain the timber extends almost to the summit, so that the planed ledges appear there on a much smaller scale. They would be considered, nevertheless, fine examples of ice action were not Kearsarge so near. There is one noticeable groove on Mount Ragged, cut into the ridge at the northeastern side of the summit, which is some twelve or fifteen inches wide and at one point nearly the same depth. Its section is a U. This groove gradually shallows out in following it southeastward, but, if I remember rightly, it is easily traced for twenty-five or thirty feet.

Although not very large the boulders on Kearsarge are very noticeable, for they are composed of a white porphyritic gneiss which contrasts vividly with the gray schists upon which they often directly rest.

The porphyritic gneiss when fresh has a slightly bluish tinge of color, but the large feldspar crystals, which make up nearly the entire mass of the rock, weather to a milky whiteness. There is a fragment of one of the boulders on the table.

A belt of porphyritic gneiss borders the Kearsarge schists on the west, the line of contact running along the base of the mountain. The belt is only a few miles wide and it contains, besides Mount Cardigan, situated near its northern extremity, no elevation greater than 1600 feet. Boulders from Mount Cardigan would probably have passed some distance to the north of Kearsarge, and it seems probable, therefore, that the boulders found near the summit of the latter mountain were elevated over 1000 feet, and this while traversing a distance of about seven miles. The boulder shown in one of the photographs is about four feet in greatest diameter. Lower down, near the Winslow House, there are two or three boulders eight or ten feet high; but I saw none much larger than this on the north side of the mountain. On the west side of the southwest spur, near its end, there are, however, some boulders which I should judge to be fifteen or twenty feet in diameter, but I saw them through the woods and from a little distance. They appeared angular, and they may not have travelled more than a few hundred feet. On the east side of a bluff of porphyritic gneiss bordering the Blackwater River, near West Andover the ground is thickly strewn for about a quarter of a mile down the valley with boulders of nearly every size and shape. These, I think, were broken off the bluff by floating ice after the recession of the glacier from the valley.

Of drift other than boulders I have but few notes. There are two lenticular hills or drumlins mapped by the State Survey, which I have marked on the enlarged map. These hills do not appear to be common in this region, though they form a marked feature in the landscape in the southeastern part of the State. On Kearsarge itself there are some rather curious looking hills of drift in the "sag," south of the Winslow House at an elevation above sea of about 1,600 feet, but I did not have a chance to examine them closely. No accumulations of gravel were seen on the northwest side of the mountain above the 1,800-foot contour.

The Blackwater Valley west of Kearsarge is bottomed with stratified drift.

Altogether Kearsarge presents probably as many interesting evidences of glaciation as any spot in New Hampshire, and is worthy of a much more thorough study than it has yet received.

THE COLORATION OF FISHES.

By RICHARD BLISS, Jr.*

NOTES ON OUR LOCAL BIRDS.

By AMON PARMENTER.*

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*Titles of addresses before the Society September 4th and October 2d, 1884. (No abstracts furnished for publication by the authors.)

ON METAMORPHISM IN THE RHODE ISLAND COAL BASIN.

By T. NELSON DALE.*

Sir Charles Lyell, in a paper read before the Geological Society of London in 1844, called the attention of British Geologists to the occurrence near Worcester, in Massachusetts, of a bed of Plumbago and Anthracite, which he was inclined to believe belonged to the Carboniferous Formation. The Geological Survey of Rhode Island by Dr. Jackson, published in 1840, that of Massachusetts by President Edward Hitchcock in 1841, a short paper by the same on the Rhode Island coal field in 1853, as well as two papers by his son, Prof. Charles H. Hitchcock, in 1860, have clearly established the fact that there extends from the vicinity of Worcester, Mass., to the southern extremity of Rhode Island, a more or less broken belt of rocks of Carboniferous age; and these writers all concur in describing these rocks as materially different from those of the best known coal fields. Instead of bituminous coal or of Anthracite, we find there a plumbaginous Anthracite; instead of the accompanying clays and clay-slates, we find clay-slates and Mica-schists. The southern portion of the belt, at least, is traversed by numerous Quartz veins, and all the rocks and minerals of the region indicate varying degrees of metamorphism. During the last few years the writer has devoted considerable time to the construction of a geological map of the vicinity of Newport, R. I., and of a geological section across the entire basin, which at that point measures some fifteen miles in width. Since the publication of the results of this work, in extending during last summer the observations northwards, I came upon a locality where the metamorphism of the coal-measures had proceeded further than it is supposed to have done even in that region. The object of this paper is to give a brief statement of these observations.

In the western part of the basin, along the West Passage of Narragansett Bay, the strata of the Coal-measures are much disturbed, being in places vertical or folded over upon themselves.

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*Reprinted from "Proceedings of the Canadian Institute," Toronto, March, 1885, p. 18.

In accordance with the geological law that regions of the greatest disturbance are generally those of the greatest metamorphism, it is not strange that the rocks of the West Passage are more metamorphic than those of other portions of this section of the basin. On the west shore of the Island of Conanicut the Coal-measures dip E.S.E. true, away from the west side of the basin, the nearest rocks to the west being the Mica-schist (B), which forms there the shore of the mainland. In examining the outcrops on the west shore of the northern portion of Conanicut, which, with occasional interruptions, extend some three miles or more, I noted the following section, beginning with the more recent strata:

Mica-schist with Garnets, Staurolite, Ottrelite and Chlorite, 4 feet.

Plumbaginous Argillyte, with minute veins of Mica and coal ferns, 3 feet.

Mica-schist with Garnets, Staurolite, Ottrelite and Chlorite (including 2 feet of Plumbaginous-schist), 10 feet.

Several layers covered, but conformable.

Mica-schist with Garnets and Chlorite (including a few inches of Plumbaginous Argillyte), 3½ feet.

Quartzose Mica-schist (including 2 feet of Quartzyte with radiate Asbestus), 7 feet.

Plumbaginous Argillyte with Garnets and Chlorite, 2 feet.

Mica-schist with Garnets, Staurolite, Ottrelite and Chlorite, 8 feet.

The Staurolites occur as single crystals, twins of 60°, and drillings. The Garnets and Staurolites are generally partial pseudomorphs of Chlorite after Garnet or Staurolite.

If such highly crystalline Paleozoic rocks occur in one region they may elsewhere; and it would not be surprising if some metamorphic rocks, now regarded as of Azoic or Eozoic age, should be ultimately found to belong to the Paleozoic.

NATIVE PLANTS OF THE ISLAND OF RHODE ISLAND.

During the past year, the Newport Natural History Society assigned to two of its members the task of preparing a list of plants and trees growing in that portion of Rhode Island comprising Newport, Middletown and Portsmouth.

Although the preparation of a complete flora of even a small section must occupy a number of years, the following is the first of a series of papers which will be published, from time to time, in the proceedings of the Society.

When the flora is complete, it is proposed to publish it with the location, as far as possible, of each plant and tree so that the work may be of the greatest possible benefit to those interested in the study of Botany.

A few of the plants mentioned in the accompanying list, not originally native, have been transplanted and are now growing wild.

RANUNCULACEÆ.

Hepatica triloba, Liver-leaf.
Anemone nemorosa, Wind-flower.
Thalictrum anemonoides, Rue-Anemone.
Ranunculus fascicularis, Early Buttercup.
Ranunculus bulbosus, Bulbous Buttercup.
Ranunculus repens, Creeping Buttercup.
Caltha palustris, Marsh-Marigold.
Aquilegia canadensis, Wild Columbine.

NYMPHÆACÆ.

Nymphæa odorata, White Water-Lily.

CRUCIFERÆ.

Nasturtium officinale, Water-Cress.
Draba verna, Whitlow Grass.
Capsella Bursa-Pastoris, Shepherd's Purse.

VIOLACEÆ.

Viola cucullata, Common Blue Violet.
Viola sagittata, Arrow-leaved Violet.
Viola blanda, Sweet White Violet.
Viola lanceolata, Lance-leaved Violet.

HYPERICACEÆ.

Hypericum perforatum, Common St. John's Wort.

CARYOPHYLLACEÆ.

Spergularia rubra, Sand Spurrey.

Stellaria media, Chickweed.

MALVACEÆ.

Malva rotundifolia, Common Mallow.

GERANIACEÆ.

Oxalis stricta, Yellow Wood-Sorrel.

Geranium maculatum, Spotted Cranesbill.

Impatiens fulva, Jewel Weed.

LEGUMINOSÆ.

Trifolium arvense, Rabbit Foot Clover.

Trifolium pratense, Red Clover.

Trifolium medium, Zigzag Clover.

Trifolium agrarium, Yellow Hop Clover.

Trifolium repens, White Clover.

Melilotus officinalis, Yellow Sweet Clover.

Melilotus alba, White Sweet Clover.

Lathyrus palustris, Vetchling.

ROSACEÆ.

Spiræa tomentosa, Hardhack.

Potentilla canadensis, Wild Five-finger.

Fragraria vesca, Strawberry.

Rubus villosus, High Blackberry.

Rubus canadensis, Low Blackberry.

Rosa lucida, Dwarf Wild Rose.

SAXIFRAGACEÆ.

Saxifraga virginiensis, Early Saxifrage.

ONAGRACEÆ.

Œnothera biennis, Common Evening Primrose.

Œnothera fruticosa, Low Evening Primrose.

Œnothera pumila, Small Evening Primrose.

RUBIACEÆ.

Cephalanthus occidentalis, Button Bush.

Houstonia cærulea, Bluets.

COMPOSITÆ.

Cirsium lanceolatum, Thistle.

Cirsium arvense, Canada Thistle.
Lappa officinalis, Burdock.
Eupatorium perfoliatum, Thoroughwort.
Taraxacum dens-leonis, Dandelion.
Rudbeckia hirta, Corn flower.
Bidens frondosa, Beggar-ticks.
Maruta cotula, May Weed.
Achillea millefolium, Yarrow.
Leucanthemum vulgare, Ox-eye Daisy.

LOBELIACEÆ.

Lobelia cardinalis, Cardinal Flower.

ERICACEÆ.

Epigæa repens, Trailing Arbutus, May Flower.
Clethra alnifolia, Sweet Pepperbush.
Kalmia glauca, Pale Laurel.

PLANTAGINACEÆ.

Plantago major, Common Plantain.

PRIMULACEÆ.

Lysimachia quadrifolia, Four-leaved Loosestrife.

SCROPHULARIACEÆ.

Verbascum thapsus, Common Mullein.
Linaria canadensis, Wild Toadflax.
Linaria vulgaris, Butter and Eggs.
Chelone Glabra, Snake-head.
Gerardia Maritima, Sea-side Gerardia.

GENTIANACEÆ.

Gentiana crinita, Fringed Gentian.

MYRICACEÆ.

Myrica cerifera, Bayberry.

REPORT OF THE CURATOR.

Mr. President, Ladies and Gentlemen:

In October, 1884, I had the honor of being elected your curator, in place of Dr. Mason, who then resigned that office; and it now devolves on me, in accordance with Article VI of the Constitution under which the Society is incorporated, to "make a report at the annual meeting upon the state and character of the collections."

The instruction, the precise words of which I quote, will necessarily become more definitely applicable in the course of a few years, when the contemplated collections may have assumed distinct forms, but you will at once recognize the fact, that during the very early stages of a formative process, sufficient material cannot exist for classification and scientific grouping. The beginnings of a general natural history collection may consequently be regarded as transitional in state, and shifting in character. For the present, therefore, we may accept this estimate as attaching to the many and interesting objects which kind donors have contributed during the last twelve months, as a nucleus for the museum spoken of in Section V of your By-laws. A list of the donations is appended to the present report; and the objects themselves, it is satisfactory to state, have during the last few days been deposited in a room which, after careful consideration has been rented for one year by the Society, as a central depot, small in size but admirable for access by members and others who may be interested. This room is opposite the Redwood Library on Bellevue Avenue; and, while singularly modest in its dimensions, your council believe it may suffice for some time, for the purposes in view. These are, to preserve carefully the donations presented, to have a central point to which further contributions can be sent, and to serve, through the name of the Society which is to be affixed outside, as a silent incentive to the steady accumulation of illustrative collections whose permanent home shall hereafter be in some more ambitious edifice.

Referring once more to Section V of your By-laws, I beg respectfully to point out that you have there provided that only such objects as have a scientific value are admissible to your museum. This is a salutary provision, without which, natural history collections are apt to degenerate rapidly into a heterogeneous assemblage of odds and ends, devoid of scientific value and elucidating no leading features or principles.

Your avowed aim, therefore, is that which should be the guiding theory of all local museums, namely, the formation of collections illustrating the local geology, the local fauna and the local flora, both terrestrial and marine. By the word local we may understand in its primary meaning the neighborhood, say the vicinity of Newport, the entire island of Rhode Island proper, and the adjacent shores of the mainland with the surrounding waters and their small islets. In a secondary and larger sense the term local might hereafter be construed so as to extend to the whole State of Rhode Island; but for the present it is submitted that it may be better to confine our own investigations to the more restricted area indicated by the primary meaning of the term. The projected collections would, therefore, fall under the following heads:—

A collection of the local rocks; a paleontological collection, i. e. a series of local fossils; a collection of the local minerals; a collection of the local animals and birds; a collection of the local insects, spiders, &c.; a collection of the local fishes and crustaceans; a collection of the lower forms of animal life; a collection of seaweeds from our shores; a collection of shells from our coast, also a series of the fluviatile and terrestrial species; a local herbarium, comprising a series of all the wild plants and flowers of the neighborhood, and sectional cuttings of the indigenous forest trees, with pressed leaves of their foliage.

Such an aggregation of collections, when carefully classified and named, would in time, be well worthy of a special building or museum for its reception. To the man of science it would be invaluable for reference; and to our teachers of youth it would be a potent aid in grafting on the minds of our boys and girls that love of natural history, which, wherever their lots may be cast in mature life, cannot but prove an unfailing source of pleasure and improvement.

The second class of objects to be concentrated in your Newport museum of the future, though much less important, must not be overlooked. Specimens belonging to any branch of natural history from other parts of the United States, and series of objects from foreign countries, have a positive value; and it would be a mistake to ignore the deep interest which the general public take in miscellaneous objects of this character. It is not only natural but praiseworthy, that those who have visited distant countries, should, year by year, seek to deposit, for the public good, in a city to which the ties of birth or of affectionate associations bind them, such objects of interest as they may have gathered in their travels. Section V of your By-laws reserves space for such; but what is respectfully and earnestly contended for in this report, is the necessity of subordinating this miscellaneous element—[which can find appropriate and full development in the general museums of large cities like New York, Boston or Philadelphia]—to the main object our Society should keep in view, namely the formation of local collections. So far, looking at the list of what has been already presented, the extraneous or miscellaneous element seems to have predominated, and for the future, we should try to reverse this.

Some practical suggestions may possibly not be regarded as out of place from your curator in such an initial report as the present one. It might then be borne in mind that the following branches of natural history do not present much difficulty in their practical investigation, and that many of the members might, during the coming summer, collect in the selected departments now specified, namely, minerals, carboniferous and other fossils, shells, of which one member might undertake the littoral, a second the fluviatile, and a third the land shells; insects, one undertaking the Lepidoptera, a second, the Coleoptera, and a third the spiders or Arachnida; marine Algæ or seaweeds, the collection and manipulation of which are well suited for lady members, as their preparation infers both patience and delicacy of touch; plants, one undertaking the grasses, another the ferns, another the flowering plants, and so on. Limitation to one family of a class is a good rule for a collector, for, if too wide a class be attempted, a partial and imperfect list is often the result.

These seem to be the simplest paths of inquiry in which collections can be set afoot; and, before winter commences, the collections can be brought into your depository, where the specimens may be identified, named and a scientific arrangement begun. All collectors should bear in mind to note carefully the locality from which derived, with any special circumstance bearing thereon. In some classes of objects, such as lithological specimens, unless details are recorded with perfect accuracy, and accompany the fragments of rocks, the specimens themselves become quite worthless for any scientific purpose. As the geology of Rhode Island, on account of the metamorphism of many of the strata, is singularly complicated, your local lithological collection had, therefore, better be undertaken by those who are specially conversant with that branch of study; but an interesting collection of minerals from the neighborhood can be formed with facility by the general student.

These suggestions, admittedly imperfect in their extent, are respectfully laid before you, in the hope that some real out-of-door work may be commenced by the members this year in the field, on the shore and on the surrounding waters.

Such work is in itself a reward; and it should be remembered that no matter how small or incomplete our collections may be at first, if investigation be steadily continued, the persistent accumulation of typical specimens in any branch of natural history is virtually the recording in visible forms, of actual facts in the domain of nature. Upon such tangible facts, when combined and compared with the mental inductions which follow from previously ascertained phenomena, is formed the true basis on which all scientific conclusions rest.

I have the honor to be, ladies and gentlemen, your obedient servant,

A. O'D. TAYLOR, Curator.

Newport, R. I., May 7, 1885.

NOTES ON FIVE SPECIES OF BIRDS FROM IRELAND.

By A. O'D. TAYLOR.*

BUFFALO HUNTING IN KANSAS.

By RICHARD BLISS, Jr.*

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*Titles of addresses before the Society March 6th, 1885. (No abstracts furnished for publication by the authors.)

DONATIONS TO MUSEUM.

Sword of sword fish, Nantucket; Osteological specimens; Back of snapping turtle, (Chelydra Serpentina,) (Bailey's Beach); Scales of Tarpum, Newport; A Marmoset Monkey, (mounted) S. America; Cypræa, East Indies; Fungus, Lennoxville, Canada; Shingle from the Sequoia Gigantea, Cal; Mica schist, with network of quartz vein, probably from Newport; Dr. S. W. Francis.

Fragment of Ammonite, probably from England; S. Corday Francis.

Excrescence on tree stem, used by Indians as a pestle; Richard J. Arnold, Esq.

Fossil plant stem from conglomerate boulder, Castle Hill; Messrs. Southwick and Dale.

Fossil plant stem from boulder, bed of Taunton River, near North Dighton; Col. George H. Elliot.

Squilla, dredged at Providence; Col. George H. Elliot.

Coal plants, Wood's Castle; Prof. T. N. Dale.

Mrs. Clara Ives, Newport; a geological specimen from the vicinity of Boston, Massachusetts, supposed to present marks of igneous action as well as of sedimentary deposit.

Dr. J. B. Parker, U. S. Navy, Newport; Garnets from Alaska.

Mr. Henry A. Rice, Boston; An Amazon Stone and a Cairngorm, also a fossil shell from Colorado.

Dr. W. C. Rives, Jr., Newport; Argillaceous schist from Conanicut Island.

Captain E. O. Matthews, U. S. Navy, Newport; Pitch from Pitch Lake, Trinidad.

Mr. J. M. K. Southwick, Newport; fish (mounted) from Newport Harbor.

Dr. Turner, Newport; a living green Turtle.*

Dr. A. P. Baker, Newport; a young Alligator.*

Mr. Almon, Newport; Brain Coral from Nassau, New Providence.

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*Both now deposited in Central Park Gardens, New York.

Miss Storer, Newport; small Tortoise (in alcohol).

Messrs. La Farge and Jacob, Newport; a wood duck (mounted) shot near Newport.

Dr. Storer, Newport; fruit of oil-palm from Western Africa.

Dr. S. W. Francis, Newport; fruit from a Japanese quince tree grown in Newport.

Mr. George H. Norman, Newport; Skull of a black fish.

Dr. S.W. Francis, Newport; Sword of a sword fish (duplicate).

Miss H. C. Ellery, Newport; a collection of lithological specimens from New Jersey, formed by Professor C. A. Leveridge of Cranford, Union County, New Jersey, 127 varieties.

Mr. Amory Austin, Newport; specimens of pyrolusite and iron pyrites.

Captain E. O. Matthews, U. S. Navy, Newport; fruit, etc., of the nutmeg tree from Trinidad.

Colonel John McPherson Creighton, fossil teeth of shark from South Carolina.

Mr. Charles Hunter, Newport; Seagull shot at Easton's Beach, Newport.

Rev. Father Coyle, Newport; Cormorant (spring plumage) shot at Newport (mounted).

Miss Louisa Cutler Francis, Newport; Carving cut out of bamboo root into the shapes of Chinese man and boy.

Mr. William Peck, Newport; Mistletoe from England.

Mr. Bancel La Farge, Newport; a collection of Shells, chiefly foreign.

Mr. John M. Swan, Jr., Newport; grey oölitic limestone from Bowling Green, Kentucky.

Serpentine and crystals of iron pyrites; by Mr. Westcott.

A Balanus from Yorktown Cliffs; Mr. Michael McCarty.

Portion of petrified apple tree from the Thomas Lawton farm, Coddington Point; Mr. Daniel Austin.

Fungus from apple tree; Sapling distorted by vine, Berkeley, Mass.; Specimen of Bamboo; Mr. J. M. K. Southwick.

A twin cream-nut; Mr. Charles Williams.

Specimen of copper ore; Hon. Wm. Gilpin.

Stalactite from Matanzas, Cuba; from Mr. Andrew B. Almon.

Mahogany voting box; from Mr. Parmenter.

DONATIONS TO THE LIBRARY.

U. S. Coast Survey, map of Alaska ; from Dr. J. B. Parker.

Smithsonian Report for 1882.

Transactions of the Linnæan Society of New York, Vols. I and II—1882-1884 ; from the Society.

Annual Reports of the Board of Commissioners of Central Park, New York, 1859-61-2-3 ; from Dr. S. W. Francis.

Report on the Geology of Pennsylvania, by Professor H. D. Rogers—three volumes and maps ; from Miss Mary Rogers.

Journal of the Cincinnati Society of Natural History.

On the Osteology of the Anterior Vertebræ in Doras Niger, etc., by Richard Bliss, Jr. ; from the author.

Journal of Mycology, Manhattan, Kansas, Vol. I, No. 1.

The Fresh-water Flora and Fauna of Central Park, New York, by L. P. Gratacap and A. Woodward ; from Dr. Wm. A. Conklin.

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